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COMPREHENSIVE GROUND-WATER MONITORING EVALUATION

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REPORT

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U.S. Environmental Protection Agency
Office of Waste Programs Enforcement
Contract No. 68-W9-0006

FINAL REPORT

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION

U.S. DEPARTMENT OF ENERGY
FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

TES 9

Technical Enforcement Support at Hazardous Waste Sites
Zone III
Regions 5,6, and 7

prc

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FINAL REPORT

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION

U.S. DEPARTMENT OF ENERGY FEED MATERIALS PRODUCTION CENTER FERNALD, OHIO

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
Washington, D.C. 20460

Work Assignment No.	:	R05002
EPA Region	:	5
Site No.	:	OH6 890 008 976
Date Prepared	:	September 29, 1989
Contract No.	:	68-W9-0006
PRC No.	:	009R05002
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EXECUTIVE SUMMARY

PRC conducted a comprehensive ground-water monitoring evaluation (CME) inspection of the Feed Materials Production Center (FMPC) in Fernald, Ohio. This work assignment (R05002) was completed as part of U.S. EPA contract No. 68-W9-006 (TES 9). Activities at the FMPC include manufacturing metallic uranium fuel elements and target cores for use in reactors owned by the Department of Energy (DOE). The facility is owned by DOE but operated by Westinghouse Materials Company of Ohio (WMCO). Since the facility has a long history of RCRA detection and assessment monitoring, the specific inspection objectives were to examine the detection monitoring system and evaluate the assessment monitoring program. Waste Pit No. 4, the one RCRA-regulated land disposal unit at the FMPC that requires ground-water monitoring, is the focus of this CME. To understand the facility's RCRA assessment program, however, it is necessary to understand the entire facility, because Waste Pit No. 4 is surrounded by several production and waste disposal operations that may be sources of ground-water contamination. On July 10, 1989, U.S. DOE notified U.S. EPA that hazardous waste was also placed in Waste Pit No. 5 and the clearwell. DOE also indicated that hazardous waste may also have been placed in the biodinitrification impoundment and two sludge ponds.

The facility is divided into three main areas:

- The production area in the northeast section of the facility. This area produces uranium metals products from a series of metallurgical conversions in nine specialized plants.
- The waste pit/K65 silo area located in the northwest portion of the facility. This area was the main waste disposal area from 1951 to 1986 and includes Waste Pit No. 4. Waste materials disposed of in the waste pits include radioactive materials such as uranium and thorium. In addition, waste containing solvents, heavy metals, and PCBs were disposed of in these pits.
- The suspect areas, at several locations throughout the facility, that may also be contaminating the ground water. One suspect area of major concern is the south field area where uranium-contaminated ground water is migrating off-site at a rapid rate.

The FMPC is conducting a site-wide remedial investigation and feasibility study (RI/FS) that includes all three areas.

The hydrogeology of the FMPC consists of an upper till unit, approximately 40 feet thick, underlain by a 160-foot-thick sand and gravel deposit. The northern half of the FMPC (including the waste pit area) is underlain by this till deposit. The composition of the till and the movement of ground water through the till are very complex. The ground water in the till aquifer generally is perched, and a persistent ground-water high is in the vicinity of Waste Pit No. 4. The sand and gravel aquifer beneath the till aquifer is also unconfined with ground-water flow to the east.

Ground-water contamination exists in both aquifers. Total uranium concentrations in the till aquifer are reported as high as 15,000 ug/L near Waste Pit No. 4. Total uranium in the sand and gravel aquifer is reported as high as 130 ug/L in the south field area. Uranium-contaminated ground water was also detected in both aquifers at several other areas of the site. Since several ground-water contaminant plumes tend to merge together, DOE has not identified a unique source for any of the plumes. VOC-contaminated ground water has also been constantly detected in wells adjacent to Waste Pit No. 4 and other isolated areas around the facility. All the site-related contamination is being investigated and will be remediated under the site-wide RI/FS.

One unit at the FMPC is an interim status disposal unit, Waste Pit No. 4. In 1985, detection monitoring began for the waste pit. In November 1987, DOE notified U.S. EPA that statistical methods confirmed that Waste Pit No. 4 may be affecting ground-water quality. DOE submitted a Ground-Water Quality Assessment Program Plan (GWQAPP) to U.S. EPA and continued quarterly sampling of a newly installed assessment monitoring well network (the network was installed as part of the site-wide RI/FS). This first GWQAPP was subsequently revised to address deficiencies identified by U.S. EPA. The revised GWQAPP was submitted to U.S. EPA in March 1989.

As detailed in the GWQAPP, Waste Pit No. 4 is being assessed by quarterly monitoring of 14 till wells located at the perimeter of the waste pit area. DOE is not monitoring wells adjacent to Waste Pit No. 4 because it states that a contaminant unique to Waste Pit No. 4 cannot be identified. Likewise, the sand and gravel aquifer in the northern portion of the site is being monitored with 23 wells located in a line starting at the waste pit and extending eastward. The assessment program consists of monitoring these wells (plus upgradient wells) until the entire waste pit area is remediated under the site-wide RI/FS. At that time, DOE will conduct ground-water monitoring as part of post-closure monitoring.

PRC identified several technical deficiencies and regulatory violations while conducting the CME. Some of the technical deficiencies related to the GWQAPP include the following:

- DOE did not take prompt action when the second quarterly sampling period in May 1986 indicated that Waste Pit No. 4 may be affecting the ground-water quality. Instead, DOE continued its detection monitoring program and did not notify U.S. EPA until November 1987 that an assessment program was necessary.

- The GWQAPP does not contain a schedule with milestones specific to Waste Pit No. 4 and other unauthorized land disposal units.

- The hydrogeology of the glacial till aquifer and subsequently ground-water flow zones has not been adequately characterized. The four wells tested for hydraulic conductivity in the waste pit area do not provide sufficient data to characterize this unit. In addition, monthly variation in ground-water flow has not been addressed.

Some of the regulatory violations related to the GWQAPP include the following (applicable regulations are noted in parentheses):

- The use of wells to monitor the till aquifer at only the perimeter of the waste pit area, but not adjacent to Waste Pit No. 4, will not determine the ground-water concentrations of hazardous constituents throughout the plume (265.93(d)(4)(ii)) (OAC 3745-65-93(D)(4)(b)) or characterize the contaminant plume (270.14(c)(4)) (OAC 3745-70-14(C)(4)).

- The locations of assessment monitoring wells completed in the till aquifer will not define the extent of the contaminant plume. No additional plans are stated in the GWQAPP or annual report to investigate the outer boundary of the plume past the perimeter wells (265.93(d)(4)(i)) (OAC 3745-65-93(D)(4)(a)).

- DOE failed to adequately implement the assessment program by not conducting the required analyses (VOCs) in sampling rounds 1 and 2 as specified in the GWQAPP (265.93(d)(4)) (OAC 3745-65-93(D)(4)).

- The annual report for the assessment program omitted the analytical results for several wells listed in the GWQAPP (265.94(b)(2) (OAC 3745-65-94(B)(2)).

- DOE placed hazardous waste in two unauthorized land disposal units. Because hazardous waste was disposed in two unauthorized land based units, these units are not in compliance with the 40 CFR 265 regulations.

1.0 INTRODUCTION

PRC Environmental Management Inc. (PRC) received work assignment R05002 from the U.S. Environmental Protection Agency (U.S. EPA) under contract No. 68-W9-006 (TES 9). The scope of the assignment required PRC to conduct a comprehensive ground-water monitoring evaluation (CME) inspection of the Feed Materials Production Center (FMPC) in Fernald, Ohio. The FMPC, which manufactures uranium products, is owned by the U.S. Department of Energy (DOE) and operated by Westinghouse Materials Company of Ohio (WMCO). The objective of the CME is to determine if DOE has in place a RCRA ground-water monitoring system that is adequately designed, operated, and maintained to detect releases and to define the rate and extent of contaminant migration from a regulated unit, as required under 40 CFR Parts 265 and 270.

PRC conducted the CME in accordance with the procedures outlined in the RCRA Comprehensive Ground-Water Monitoring Evaluation Document (U.S. EPA, 1988a). The CME consisted of two segments -- a records review and a field inspection. Since U.S. EPA indicated that a review of state files would not be necessary because both offices contain parallel files, PRC only examined the documents at the U.S. EPA Region 5 office. The field inspection took place during the week of June 26, 1989. The focus of the field inspection was to observe ground-water sampling techniques. Through field oversight activities at this facility under a previous TES contract, PRC had verified the location of regulated units, and well location and construction.

1.1 SPECIFIC INSPECTION OBJECTIVES

The objective of this CME inspection was to evaluate the facility's compliance with the ground-water monitoring requirements set forth in 40 CFR, Part 265, Subpart F, specifically the regulatory requirements of Subpart F that deal with assessment monitoring. The CME inspection was limited to one regulated unit, Waste Pit No. 4. However, DOE identified a second unit (Waste Pit No. 5) and other previously mentioned land disposal units that may have received RCRA waste after November 1980 and reported this unit to U.S. EPA on July 10, 1989 (DOE, 1989b). The focus of this CME is Waste Pit No. 4.

The evaluation of Waste Pit No. 4 is complicated by the fact that several contaminant investigations are being conducted at the facility. These include:

- A facilities testing program (FTP) that focuses on contaminant releases from the production areas and other suspect areas at the facility
- A site-wide remedial investigation and feasibility study (RI/FS) that focuses on the contaminants released from the waste pit area

The facility is conducting this investigation concurrently, and the data pool (monitoring wells and analytical data) is shared. For example, the facility is using 43 monitoring wells in its RCRA ground-water assessment program. These monitoring wells are also being used as part of the other contaminant investigation.

The FMPC has a long history of RCRA detection and assessment monitoring; therefore, the specific objectives of this CME were focused to:

- Examine the RCRA detection monitoring system used during the detection monitoring phase of Waste Pit No. 4.
- Evaluate the assessment monitoring phase of Waste Pit No. 4 including the number and location of wells, analytical parameters, sampling frequency, and sampling procedures.
- Evaluate compliance with ground water monitoring requirements for the recently discovered unauthorized units.

1.2 INSPECTION PARTICIPANTS

The PRC inspector was:

Edward Schuessler	Geologist	PRC

The facility inspection team consisted of several members from several companies:

Sam Cheng	Lee Wan & Associates
Sue Schneider	WMCO
Linda England	WMCO
Jack Craig	DOE
John Harmon	WMCO
Phillip Levine	WMCO
William Hertel	IT/ASI
Bob Galbriath	IT/ASI

2.0 SITE HISTORY AND OPERATIONS

This section briefly discusses the site's history and operations. The discussion is general because much of the site's history and operations are well documented in U.S. EPA and state regulatory files. However, to understand the RCRA assessment program currently being conducted at the FMPC, one needs a general understanding of the entire facility because the regulated units (Waste Pit No. 4, Waste Pit No. 5, and Clearwell) are surrounded by several production and non-RCRA waste disposal operations.

The information presented below (unless otherwise referenced) is summarized from the RI/FS work plan (DOE, 1988a), RI/FS Quality Assurance Project Plan (QAPP) (DOE, 1988b), and the Characterization Investigation Study (CIS) reports (DOE 1987a).

2.1 FACILITY LOCATION

The FMPC facility is located 20 miles north west of Cincinnati in the unincorporated town of Fernald, Ohio (Figure 1). The facility occupies approximately 1,050 acres in a rural and agricultural setting. There are two surface water bodies in the FMPC site area: Paddys Run, an intermittent stream which recharges the sand and gravel aquifer, flows near the western boundary of the site, and the Great Miami River is approximately 1 mile east of the site.

2.2 FACILITY REGULATORY HISTORY

DOE began operations at the FMPC in early 1950 when National Lead of Ohio (NLO) entered into a contract to operate the facility. NLO operated the facility from 1951 to January 1, 1986. At that time, WMCO began managing the facility under contract to DOE (DOE 1988b). Currently, all production operations at the FMPC have ceased (U.S. EPA, 1989a).

The FMPC is subject to RCRA regulations because (1) it stores hazardous waste in numerous tanks and containers and (2) disposed of hazardous waste in land based disposal units after November 1980. However, facility compliance with the RCRA regulations that apply to storage and handling of hazardous substances is outside the scope of this work assignment. As a result, the CME focused on the RCRA 265 Subpart F regulations that apply to the land based disposal units (Waste Pit No. 4).

The FMPC's RCRA detection monitoring program for Waste Pit No. 4 began in August 1985. Initial background concentrations were established based on data from four sampling rounds from August 1985 through November 1986 (Table 1). DOE confirmed, based on statistical comparisons, that the FMPC facility could be affecting ground-water quality and notified U.S. EPA of such on November 13, 1987 (DOE 1987c). On November 25, 1987, DOE

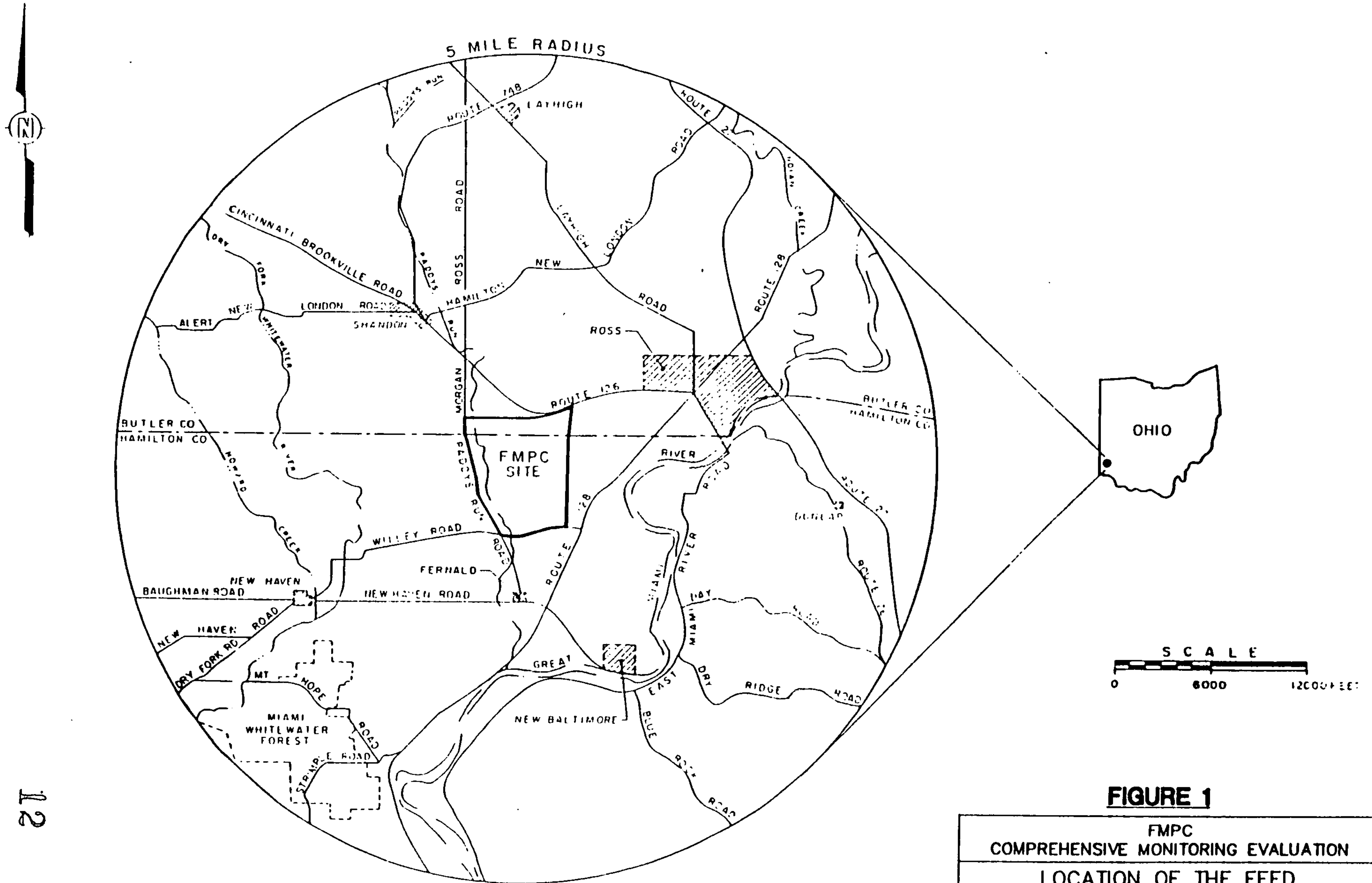

FIGURE 1

FMPC
COMPREHENSIVE MONITORING EVALUATION

LOCATION OF THE FEED MATERIALS PRODUCTION CENTER

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F1.DWG

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NOTE: REPRODUCED FROM D.O.E. 1988(a).

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TABLE 1

RCRA GROUND-WATER SAMPLING SUMMARY

Detection Monitoring	Date	Comment
Round 1		
Phase 1	August 1, 1985	4 till wells
Phase 2	August 27, 1985	7 sand and gravel wells
Phase 3	January, 1986	32 on- and off-site wells
Round 2	May 1986	41 wells
Round 3	August 1986	41 wells
Round 4	November 1986	End of background period
Round 5	May 1987	1st semiannual sampling round
Round 6	November 1987	2nd semiannual sampling round

Sources: DOE, 1987b and DOE, 1987c.

submitted a ground-water quality assessment program plan (GWQAPP) to U.S. EPA stating that Waste Pit No. 4 would be assessed as part of the site's ongoing RI/FS (DOE, 1987d). However, U.S. EPA noted several inadequacies with the plan, and DOE submitted a revised GWQAPP on March 23, 1989 (DOE, 1989a). Section 5.0 discusses the GWQAPP in more detail.

2.3 FACILITY OPERATIONS

The FMPC manufactures metallic uranium fuel elements, target cores, and other uranium products for use in reactors operated for DOE (U.S. EPA, 1988b). Past activities also included processing small amounts of thorium. In addition, thorium from other facilities is stored at the facility. The RI/FS QAPP gives a detailed discussion of plant operations.

2.4 FACILITY DESCRIPTION

The FMPC site (Figure 2) is divided into three general areas: the production area, the Waste Pit/K65 area, and the suspect areas.

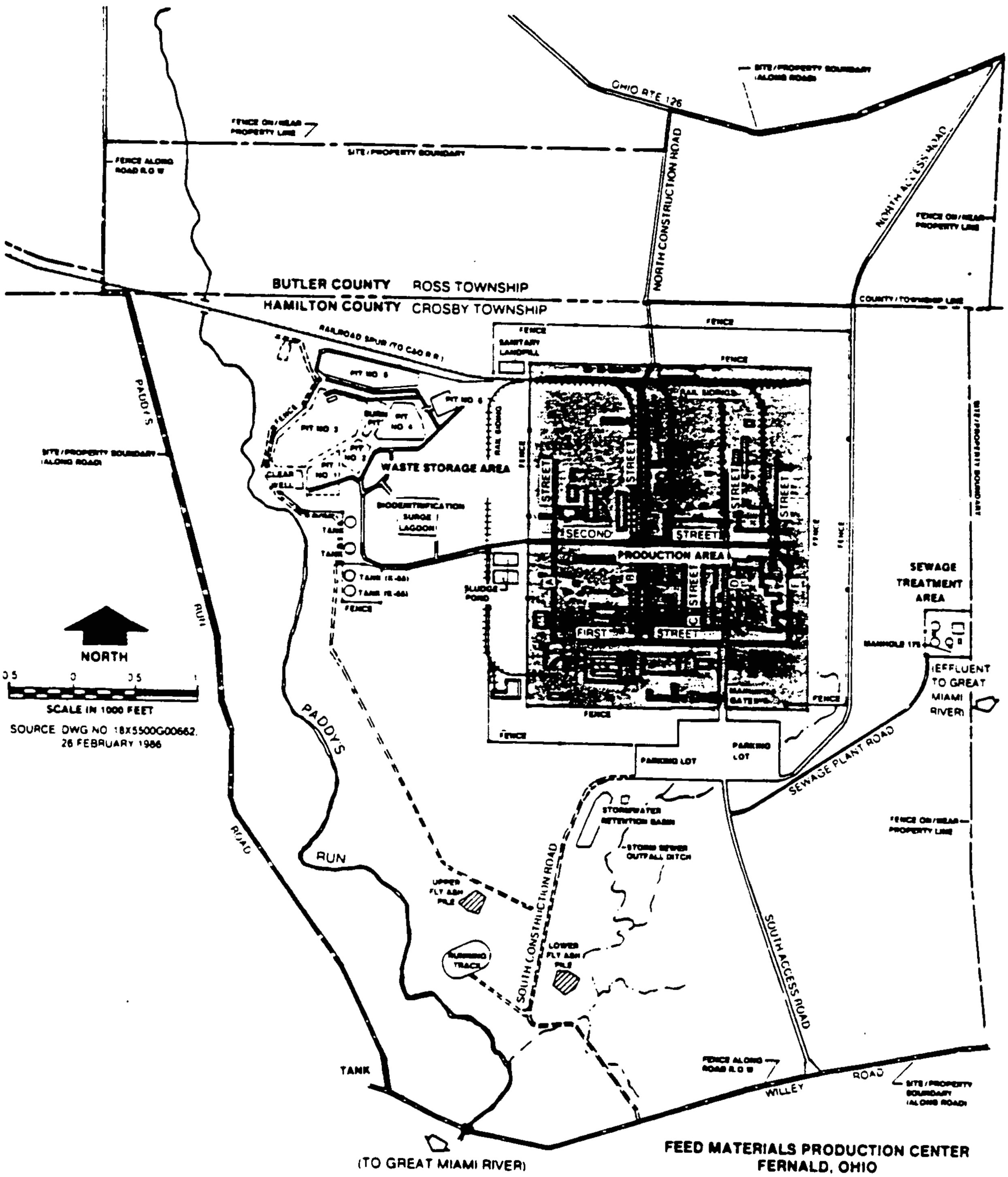
2.4.1 Production Area

The production area is located in the northeast section of the facility. Activities at the production area to produce uranium metals products involves a series of chemical and metallurgical conversions that occur in nine specialized plants. The nine plants are:

- Preparation Plant (Plant 1)
- Refinery (Plants 2 and 3)
- Green Salt Plant (Plant 4)
- Metals Production Plant (Plant 5)
- Metals Fabrication Plant (Plant 6)
- Plant 7 (Plant 7)
- Scrap Recovery Plant (Plant 8)
- Special Products Plant (Plant 9)

In addition, a number of other buildings and processes support the activities at these nine plants (DOE, 1988c).

In general, uranium production begins at the Preparation Plant with concentrated ore, recycled uranium from spent reactor fuel, or with various uranium compounds. These materials are dissolved at the Refinery, and uranium is extracted into an organic liquid and then back-extracted into dilute nitric acid to yield a solution of uranyl nitrate. Uranium trioxide is created by evaporating and heating the uranyl nitrate. The uranium trioxide is then converted to uranium tetrafloride (green salt) in the Green Salt Plant. In the Metals Production Plant, uranium



FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

MAP OF THE SITE

FIGURE 2

FMPC COMPREHENSIVE MONITORING EVALUATION		
MAP OF THE FEED MATERIALS PRODUCTION CENTER		
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NOTE: REPRODUCED FROM CHARACTERIZATION INVESTIGATION STUDY (D.O.E., 1987).

tetrafloride and magnesium are combined to produce uranium metal. This primary uranium metal is then remelted with available scrap uranium metal to yield purified uranium ingots, which are extruded in the Metals Fabrication Plant to form rods and tubes. Primary metal and metal castings of other shapes are also final products.

2.4.2 Waste Pit/K65 Area

The waste storage area (Waste Pit/K65 Area) was the principal waste storage area at the FMPC facility (DOE, 1988a). This area includes six waste storage pits and is located in the northwest portion of the facility (Figure 2). A detailed listing of the types and volumes of waste disposed of in the waste pits is provided in Volume 2 of the CIS (DOE, 1987a). In addition, Volume 2 of the CIS presents analytical results of samples taken from each waste pit. The following waste pit descriptions are summarized from the CIS. Appendix A presents summary tables.

Waste Pits No. 1 and No. 2, excavated into an existing clay lens, were used periodically from 1952 to 1959 to store and dispose of plant wastes. These pits primarily received neutralized waste filter cake, production plant sump cake, depleted slag, contaminated brick, and sump liquor. Although the primary waste disposed of in these pits were dry wastes, decant pipes from K65 silos constructed through the west berms of the pits may have contributed some liquid wastes. DOE estimates that 1,258,000 Kg of uranium and 400 Kg of thorium were disposed of in these two pits.

Waste Pit No. 3, also excavated into an existing clay lens, received wastes from 1959 through May 1968. This waste pit was operated as a settling basin from 1959 to 1968. The liquid waste stream consisted of lime-neutralized radioactive raffinate. The waste pit also received dry waste consisting of slag leach residue, filter cake, fly ash, and lime sludge. An estimated 129,000 Kg of uranium and 400 Kg of thorium were disposed of in this waste pit.

Waste Pit No. 4 was constructed in 1960 with a 2-foot compacted clay liner on the walls and bottom of the waste pit; it received wastes until 1986. This pit received cakes, slurries, raffinate, graphite, noncombustible trash, and asbestos. Barium sulfate was also a major (and unique) waste disposed of in Waste Pit No. 4. An estimated 3,000,000 Kg of uranium and 61,800 Kg of thorium were disposed of in this waste pit.

Waste Pit No. 5 was constructed in 1968 with a 60-mil synthetic liner; it received liquid waste slurries from 1968 to 1983. The liquid wastes include neutralized raffinate settling solids, slag leach slurry, sump slurries, and lime slurries. This waste pit also received water from Waste Pit No. 6 until 1987. An estimated 50,309 Kg of uranium and 17,000 Kg of thorium were disposed of in this waste pit. Recently, DOE discovered that this waste pit may have received RCRA U- and P-listed wastes from the FMPC laboratory (DOE 1989b). If this waste pit did receive RCRA waste after 1980, it should be operated and monitored as a RCRA unit. U.S. EPA has not determined the regulatory status of this unit. Water and sediment samples collected from this pit during the CIS study indicate that both arsenic and cyanide are present in both media.

Waste Pit No. 6 was constructed in 1979 with a synthetic liner; it operated until 1985. Solid wastes disposed of in this pit include green salt, filter cake, and process residues containing elevated levels of uranium. An estimated 843,142 Kg of uranium was disposed of in this waste pit.

Two other pits are located in the Waste Pit/K65 Area: the burn pit and clear well. The burn pit was constructed in 1957 and received laboratory chemicals and combustible materials. Its actual inventory of wastes and the dates of operation were not reported in the documents reviewed. The clear well was the final settling basin for surface water runoff and water from Waste Pit No. 5 prior to its discharge to the Great Miami River.

2.4.3 Suspect Areas

DOE identified several areas of possible ground-water contamination classified as "suspect areas." These areas include the south field, several rubble piles and drum storage areas, fire training pits, and a laboratory equipment burial area (DOE 1988c). Of these suspect areas, the south field area is of concern because radionuclides have contaminated the ground water. Information regarding contamination at the other areas is not available, but the areas are not RCRA regulated; therefore, these areas will not be discussed further in this CME report.

DOE concluded that the source of contamination in the south field is stormwater runoff from the FMPC production area and waste storage area. Contaminants have been transported to the south field area by surface water in Paddys Run and by the Storm Sewer Outfall Ditch. These surface water pathways have eroded the till, allowing for direct recharge to the sand and gravel aquifer (DOE 1989c).

3.0 SITE GEOLOGY

Numerous reports describe the regional and site-specific geology. However, most of the available geologic information is synthesized in the Hydrogeologic Study of FMPC Discharge to the Great Miami River (DOE 1988d). In addition, DOE is in the process of conducting a site-wide RI/FS that includes the advancement of several hundred soil borings, installation of hundreds of monitoring wells, and ground-water modeling. The general regional geologic setting is described by the topography, bedrock geology, and surficial geology. The site-specific geologic setting focuses on the two surficial geologic units: (1) surface till and (2) underlying outwash sand and gravel unit.

3.1 REGIONAL GEOLOGY

The topography in the FMPC area consists of a relatively flat glacial till plain approximately 580 feet above mean sea level (MSL) between several bedrock outcrops that reach elevations of over 800 MSL (USGS, 1981). The FMPC is located on the glacial till plain. The surface elevation of the glacial deposits ranges from 600 feet west of the FMPC to 540 feet at the Great Miami River east of the site (Figure 3).

The geology of the FMPC site area generally consists of 150 to 200 feet of Pleistocene age glacial deposits overlying Ordovician shale bedrock (Figure 4). The bedrock consists of predominantly flat-lying Ordovician shale with thin, interbedded layers of limestone. This shale is part of the Cincinnatian Series and has a total thickness of approximately 800 feet. Prior to the glacial events of the Illinoisan and Wisconsinan Periods, the ancestral Great Miami River eroded the bedrock surface and created an entrenched valley approximately 200 feet deep. This bedrock valley is 1/2 to 2 miles wide with a broad flat bottom and steep walls forming a "U" shape. During the subsequent Illinoisan and Wisconsinan (Pleistocene) glacial events, the valley was filled with glaciofluvial sand and gravel deposited by the melt waters of the retreating glaciers. Interbedded in the sand and gravel deposits are glacial till deposits of limited areal extent consisting of poorly sorted pebbles and cobbles in a clay matrix.

3.2 SITE-SPECIFIC GEOLOGY

The geology of the FMPC site consists of a surficial glacial till unit overlying the regional glacial outwash deposit described above (DOE, 1989d). The glacial till is approximately 20 to 40 feet thick, with the base of the till generally at 540 feet MSL. The till composition varies both horizontally and vertically. In general, the till consists of low permeability silty clay with some

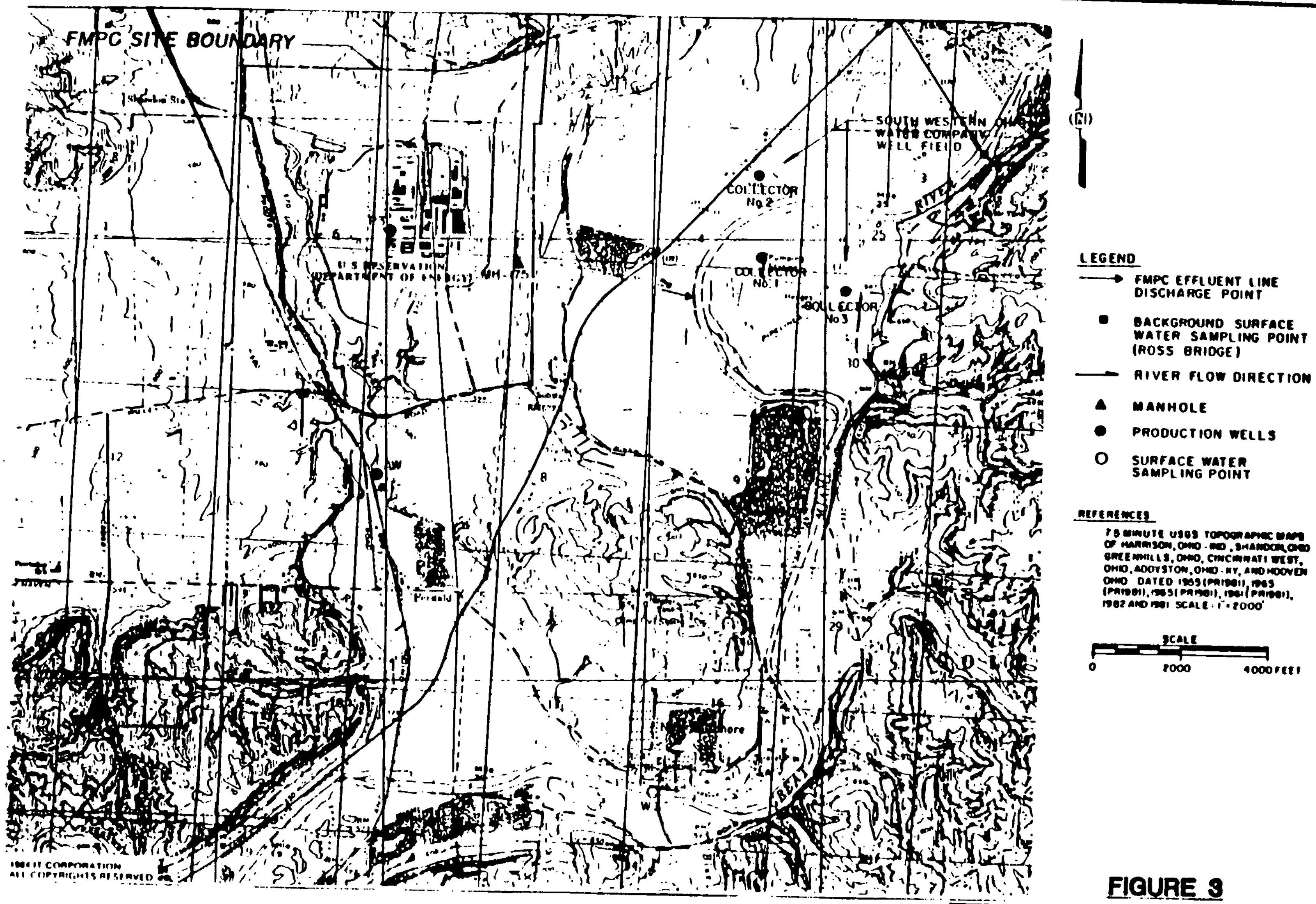

FIGURE 3

FMPC
COMPREHENSIVE MONITORING EVALUATION

TOPOGRAPHY
OF FMPC AREA

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F3.DWG

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NOTE: REPRODUCED FROM D.O.E. 1988(d).

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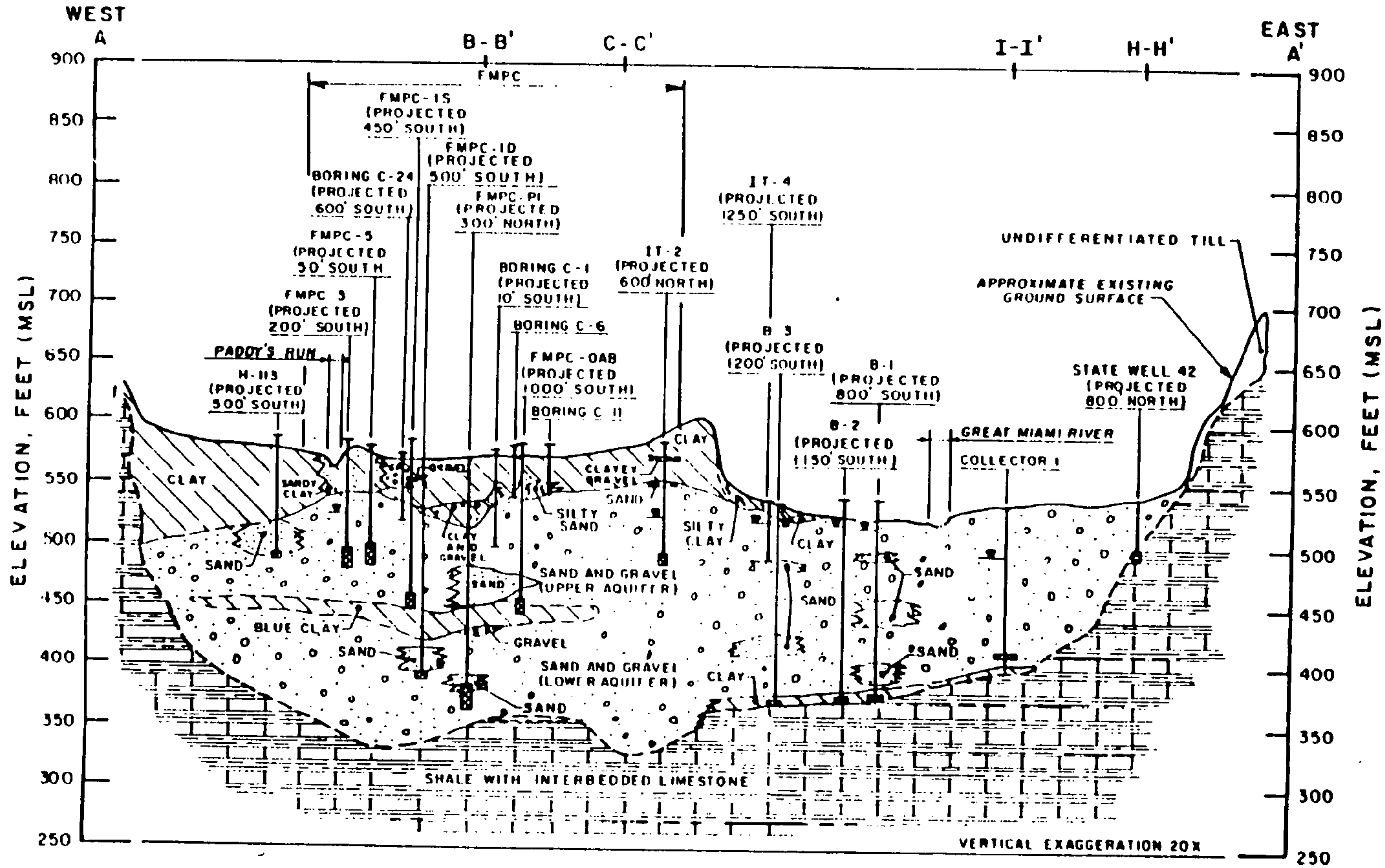

LEGEND

OPEN INTERVAL

WATER LEVELS (MEASURED 3/27/86 THRU 4/11/86.)

REFERENCES:

MODIFIED FROM U S G S. PROFESSIONAL PAPER No 605-A USING AVALIABLE OHIO STATE WATER WELL RECORDS, SOWC WATER WELL DATA, DAMES AND MOORE DOE, FEED MATERIALS PRODUCTION CENTER GROUND WATER STUDY TASKS A AND C REPORTS AND IT BORING LOGS.

FIGURE ADAPTED FROM FERNALD LITIGATION DRAWING NO 303063-B16. PREPARED FOR U S. DEPARTMENT OF ENERGY BY IT CORPORATION, NOVEMBER, 1986

CROSS SECTION A-A'

(LOOKING NORTH)

VERTICAL SCALE

0 100 200 FEET

HORIZONTAL SCALE

0 2000 4000 FEET

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS ALSO THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS

THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTIONS WERE GENERALIZED FROM AND INTERPOLATED BETWEEN THE TEST BORINGS INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE LOCATION OF THE TEST BORINGS AND IT IS POSSIBLE THAT SUBSURFACE CONDITIONS BETWEEN THE TEST BORINGS MAY VARY FROM THOSE INDICATED

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NOTE: REPRODUCED FROM D.O.E. 1988(d).

FIGURE 4

FMPC COMPREHENSIVE MONITORING EVALUATION		
GENERALIZED WEST–EAST CROSS SECTION THROUGH FMPC STUDY AREA		
CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F4.DWG
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sand and pebbles. Within the till are lenses of highly permeable sand and "flowing sands" (Galbraith, 1989). To the east and south, the till grades into a silty sand deposit described as Pleistocene lake deposit (DOE, 1989c). The till unit is extensive to the north and west to at least the limits of the boring program. However, Paddys Run has eroded the glacial till in the northwest and the glacial lake deposit in the southwest, exposing the underlying sand and gravel outwash deposit (DOE, 1989c).

Underlying the glacial till and lake deposits is a sequence of highly permeable sand and gravel outwash deposits approximately 160 feet thick, with the base at about 380 feet MSL. In the vicinity of the waste pit and western production area, this sand and gravel unit is reported to be divided by a greenish-black silty clay approximately 10 to 20 feet thick and commonly referred to as the "blue clay" (DOE, 1988b). However, based on the borelogs generated from the RI/FS and a discussion with the project geologist, this unit may not be as contiguous as previously thought; instead it may represent several discontinuous clay units at approximately the same elevation.

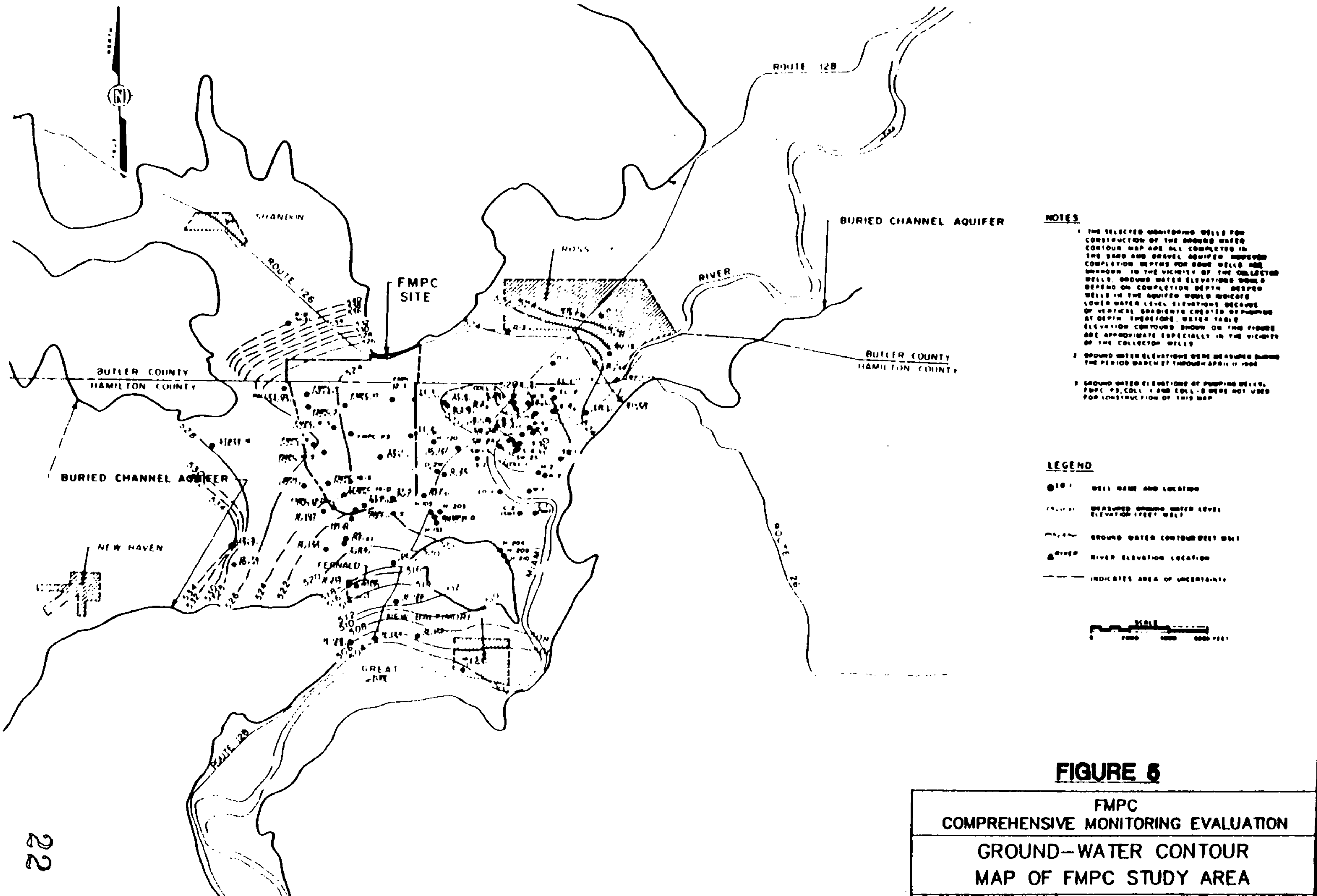
4.0 HYDROGEOLOGY

As with the geology described above, most of the available regional hydrogeology information is synthesized in the Hydrogeologic Study Of The FMPC Discharge To the Great Miami River study (DOE, 1988d). The site-specific hydrogeology is described in part by the Ground-Water Quality Assessment Program Annual Report (DOE 1989c). The hydrogeology of the sand and gravel unit has been reasonably well defined; however, the hydrogeology of the glacial till unit is very complex and has not been completely characterized. In addition, surface water bodies play a large role in the regional and site hydrogeology.

4.1 REGIONAL HYDROGEOLOGY

The regional hydrogeology consists of mainly a highly permeable glacial outwash sand and gravel aquifer within a bedrock valley. Portions of the sand and gravel aquifer are overlain by low permeability glacial till and lake plain aquifer. Since the glacial till aquifer is not regionally extensive, it is not discussed in this section.

Ground water in the sand and gravel buried valley aquifer flows from the west, north, and east toward the intersection of several buried bedrock valleys (Figure 5). Ground water exits this area by flowing southwest through a branch of the buried valley aquifer near New Baltimore,



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NOTE: REPRODUCED FROM D.O.E. 1988(d).

FIGURE 5

FMPC COMPREHENSIVE MONITORING EVALUATION		
GROUND-WATER CONTOUR MAP OF FMPC STUDY AREA		
CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F5.DWG
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Ohio. The Southern Ohio Water Company (SOWC) pumping wells produce a pronounced and persistent cone of depression and alters neutral ground-water flow significantly.

The hydrogeologic characteristics of the sand and gravel buried valley aquifer have been reported by Spieker (1968). Transmissivity values range from 4,700 to 67,000 square feet per day (ft^2/day). Spieker estimated the storage coefficient to be about 0.2. Individual wells in the area are capable of pumping up to 3,000 gallons per minute (gpm).

Two surface water bodies are of concern in the FMPC site vicinity: Paddys Run and the Great Miami River. Paddys Run, an intermittent stream that extends down the entire western edge of the FMPC, receives surface water runoff and seep water from the waste pit area (DOE 1988e). When Paddys Run is filled with surface water, it flows south and eventually discharges to the Great Miami River. The northern stretch of Paddys Run is floored by the glacial till deposit, which impedes (to some extent) surface water recharge to the underlying sand and gravel aquifer. The southern reach of Paddys Run has eroded through the glacial till, and surface water freely recharges the sand and gravel aquifer (DOE 1989c). The Great Miami River is a major surface water body approximately 4000 feet east of the FMPC. This river flows southwest and exhibits meandering patterns with sharp directional changes over short distances (DOE 1988d).

4.2 SITE HYDROGEOLOGY

The site hydrogeology consists of 2 aquifers: a perched aquifer in the surficial glacial till unit, underlain by a highly permeable regional sand and gravel buried valley aquifer. The facility has completed several wells in each aquifer; "1000" series wells are completed in the glacial till aquifer, whereas "2000," "3000," and "4,000" series wells are completed in the regional sand and gravel aquifer.

The hydrogeology of the surficial glacial till aquifer is very complex in regard to both the composition of the hydrogeologic unit (and subunits within the till) and the ground-water flow pattern. The till is a very complex glacial unit with numerous lenses of sand and gravel. Some of the sand lenses are very loose and under pressure; these area are termed "flowing sands." Insufficient information is available to determine the lateral extent of and interconnection between the sand lenses. In any event, these lenses can act as significant pathways of ground-water (and contaminant) migration. During the RI/FS field activities, slug tests were performed of the till wells to define horizontal hydraulic conductivity. Results of the slug testing are presented in Table 2 and indicated that the hydraulic conductivity of the glacial till unit is variable. The hydraulic conductivities range from a relatively high value (1.6×10^{-3} cm/sec) to a relatively low value (2.5×10^{-6} cm/sec).

TABLE 2

RESULTS OF SLUG TESTS: TILL WELLS

WELL	HYDRAULIC CONDUCTIVITY (CM/SEC)
1008	1.3×10^{-4}
1012	1.6×10^{-3}
1018	5.7×10^{-4}
1025	2.5×10^{-6}
1034	2.5×10^{-5}
1035	2.5×10^{-5}
1041	1.1×10^{-4}
1046	6.8×10^{-5}
1048	1.6×10^{-4}
1065	2.2×10^{-5}
1079	1.8×10^{-5}

Source: Reproduced from DOE 1989e.

The entire till aquifer is a perched aquifer, because unsaturated sand and gravel occurs between the till and the underlying saturated buried valley sand and gravel aquifer. No information is available regarding the amount of recharge the till aquifer contributes to the underlying sand and gravel aquifer.

The occurrence of ground water in the till is also very complex. Some wells are dry whereas other wells in the same area and of equal depth contain water. In addition, the water table elevations in some wells located in the waste pit area fluctuate greatly over time, while other wells in the same general area have relatively constant water table elevations.

PRC contoured the water table elevations in the till wells for May 1988 (water table elevations were obtained from the RI/FS database). Two wells (1084 and 1077) were excluded because the data indicate that these wells may be hydraulically separate. The contour shows a pronounce ground-water mound centered around Waste Pit No. 4 (even including wells 1084 and 1077 the ground water mound exists around Waste Pit No. 4). The water table map prepared by PRC is in general agreement with the water table map presented in the Ground-Water Quality Assessment Program Annual Report (Figure 6) (DOE, 1989c). PRC also used information from the database (DOE, 1989f) to contour water levels of subsequent months. These maps showed the ground-water mound dissipates in the fall and winter, but a ground-water high still remaining in the area of Waste Pit No. 4.

The ground water in the sand and gravel aquifer is basically unconfined (the lower portion of this aquifer may be semiconfined depending on the characteristics and extent of the blue clay). Ground-water flow in the sand and gravel aquifer is generally to the east (Figure 7) at an estimated rate of 70 feet/year (DOE, 1989c). None of the site investigations has included pump tests to determine the hydrogeologic characteristics of this aquifer (Galbraith, 1989). However, ground-water flow has been modeled using the existing data, and the model has been calibrated and verified (DOE, 1989c). A review and assessment of this model is outside the scope of this work assignment, but is being conducted under a different contract.

5.0 GROUND-WATER MONITORING SYSTEM

The FMPC is currently in assessment monitoring and uses a different ground-water monitoring system than that used for detection monitoring. This section describes the detection monitoring program and Ground-Water Quality Assessment Program.

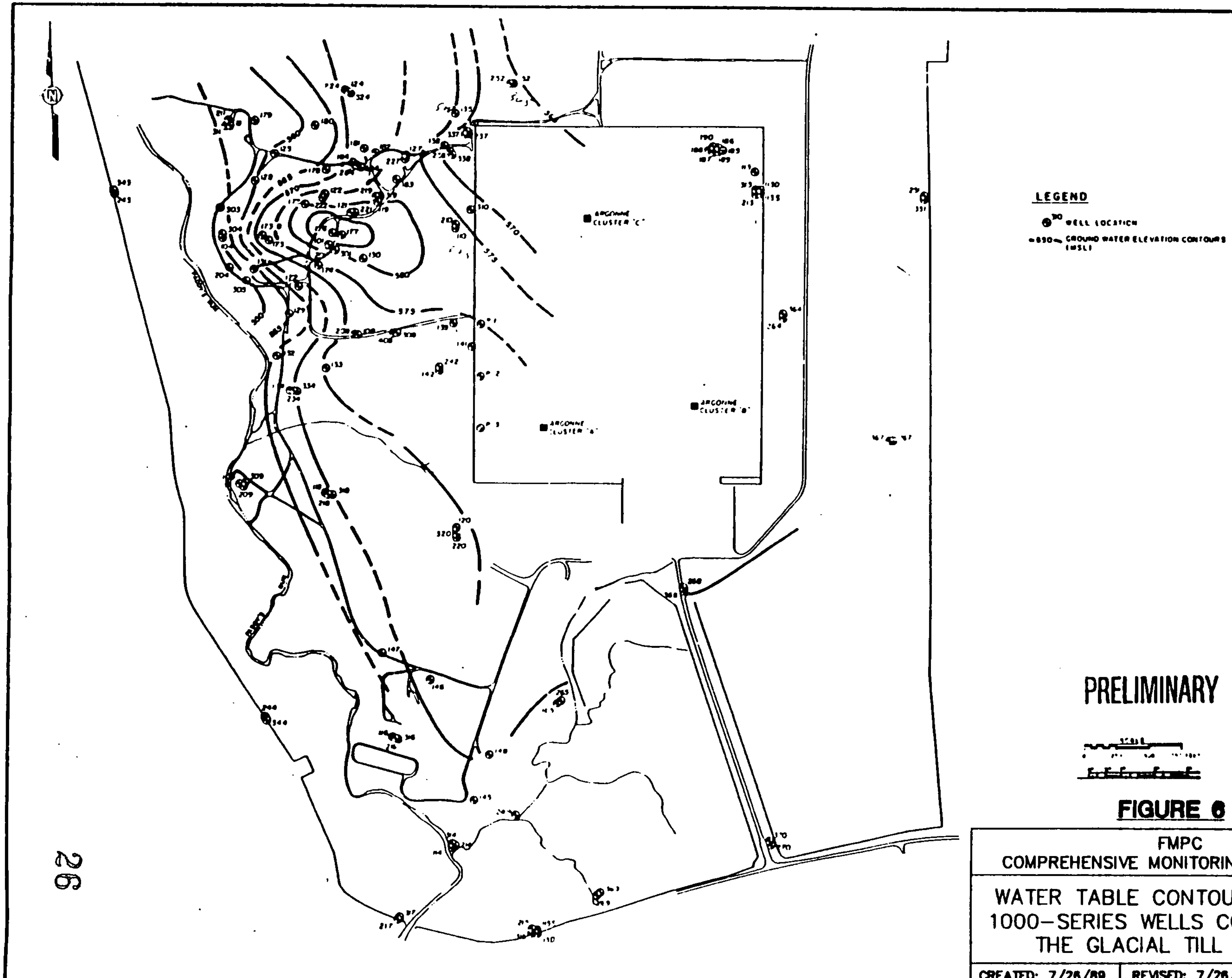

FIGURE 6

FMPC
COMPREHENSIVE MONITORING EVALUATION

WATER TABLE CONTOUR MAP OF 1000-SERIES WELLS COMPLETED IN THE GLACIAL TILL AQUIFER

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F6

PRC ENVIRONMENTAL MANAGEMENT, INC.

NOTE: REPRODUCED FROM D.O.E. 1988(c).

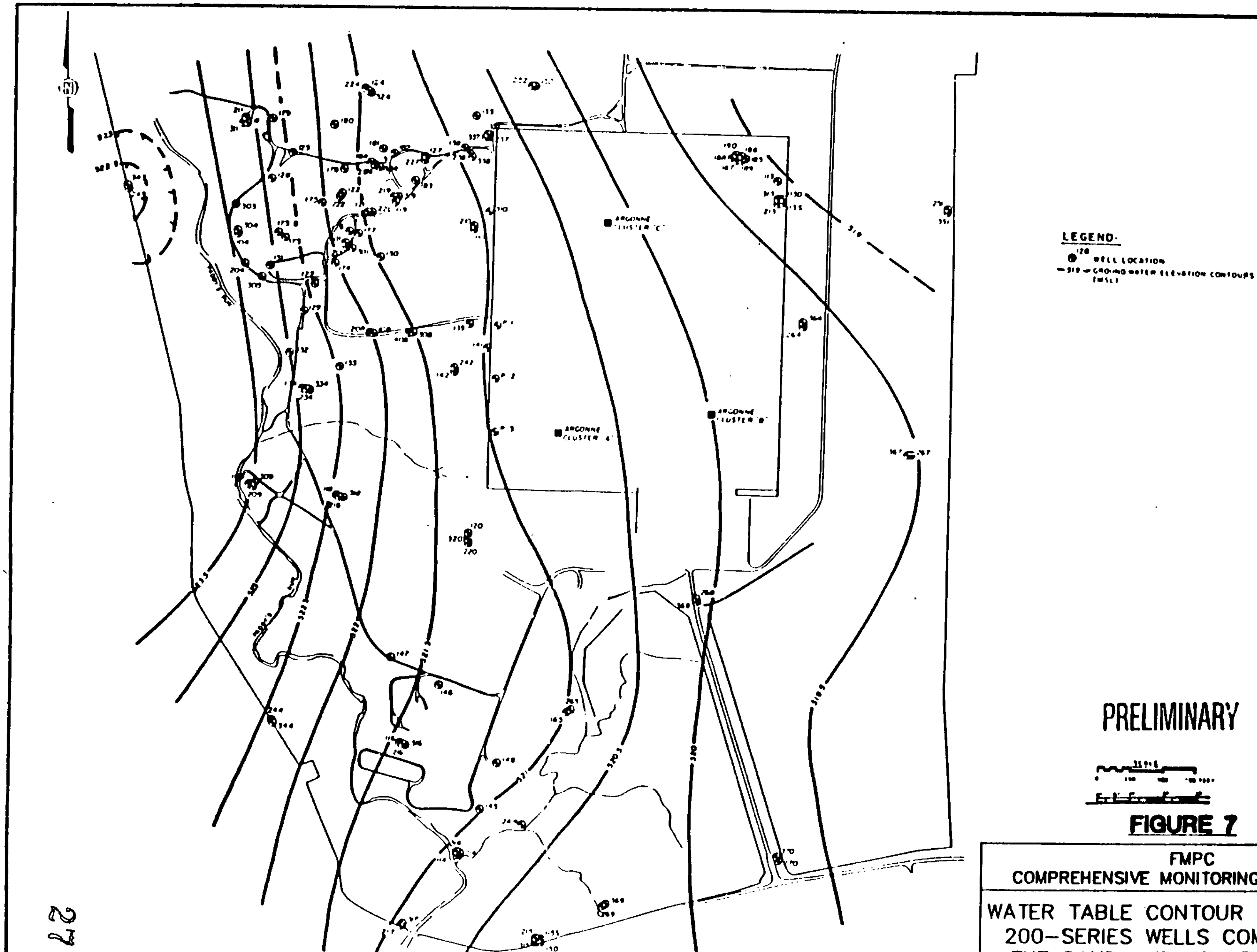

FIGURE 7

FMPC
COMPREHENSIVE MONITORING EVALUATION

WATER TABLE CONTOUR MAP OF THE 200-SERIES WELLS COMPLETED IN THE SAND AND GRAVEL AQUIFER

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F7

PRC ENVIRONMENTAL MANAGEMENT, INC.

NOTE: REPRODUCED FROM D.O.E. 1989(c).

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5.1 RCRA DETECTION MONITORING PROGRAM

The RCRA ground-water monitoring program for Waste Pit No. 4 began in August 1985. The elements of a RCRA detection monitoring program, as specified in 40 CFR Part 265, should at a minimum include the following:

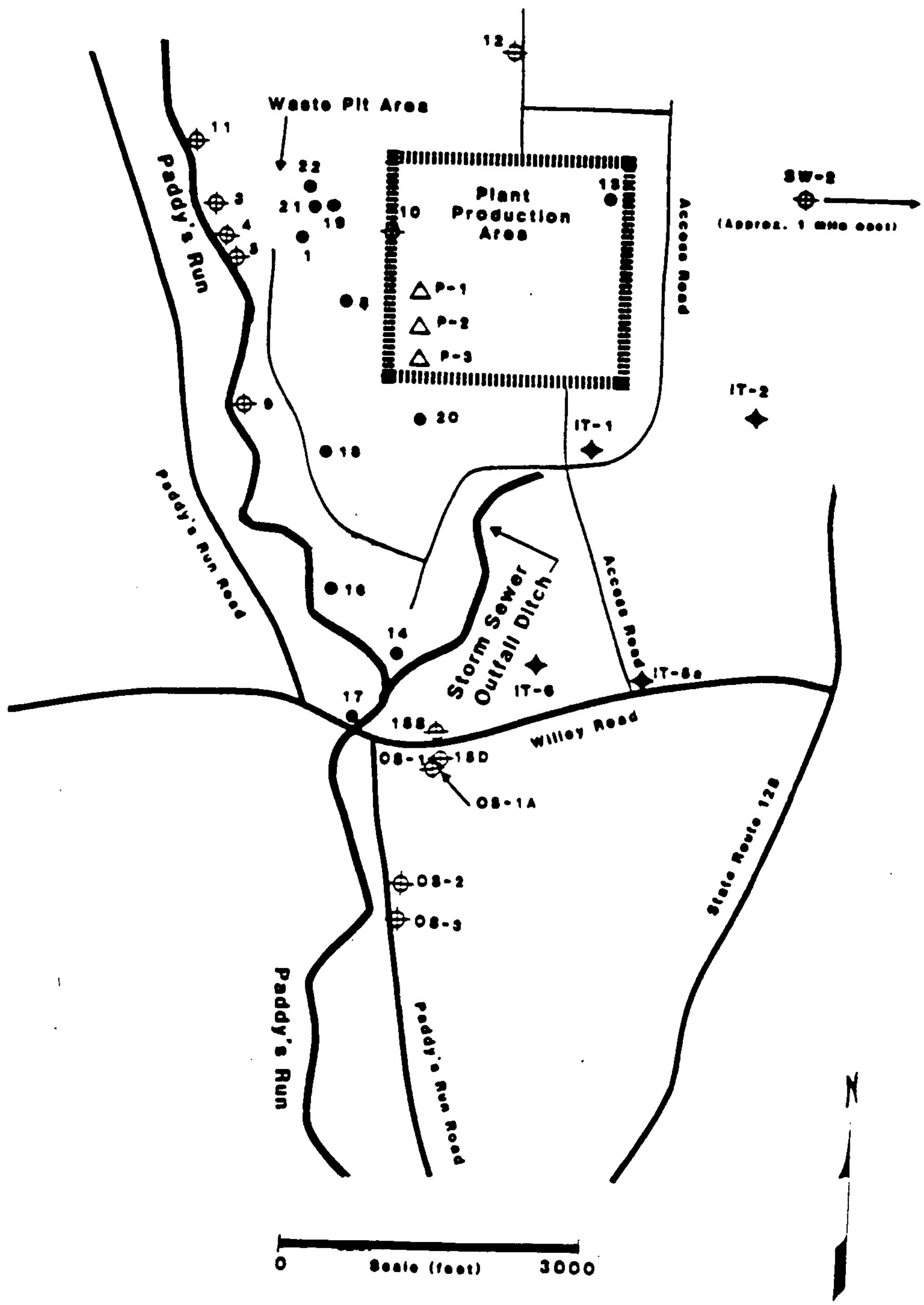
- A ground-water sampling and analysis plan
- A minimum number of wells
- Sampling of specific analytical parameters at specified intervals
- Statistical calculations and reporting

This section examines the detection monitoring system at the FMPC.

The RCRA Detection Monitoring Sampling and Analysis Plan (DOE, 1987b) includes specific procedures for sample collection, preservation, shipment, analysis, and chain-of-custody. However, the plan has several technical deficiencies, such as inappropriate containers for volatile organic compounds, inappropriate preservation for total organic carbon (TOC) samples, and no mention of replicate measurements for indicator parameters. After U.S. EPA issued a complaint, DOE addressed these deficiencies in the sampling and analysis plan prepared for the Ground-Water Quality Assessment Program Plan (GWQAPP) (DOE, 1989a).

The initial detection monitoring system consisted of 40 wells monitoring both the shallow till and deeper sand and gravel aquifers (Figure 8). However, only five nested wells were located so as to immediately detect any statistical change in the ground-water quality. The monitoring system monitored the two aquifers through two networks. As a result, each of the two monitoring networks had its own upgradient well.

As part of the RCRA detection monitoring program DOE should collect and analyze samples for drinking water parameters, ground-water quality, and contaminant indicator parameters at time intervals specified in 40 CFR 265 Subpart F. This includes collecting samples for all parameters at upgradient and background wells quarterly to establish existing and background conditions. However, the initial background sampling period consisted of collecting the first quarter samples over a 5-month period. The next three sampling rounds were conducted at 3-month intervals. The background sampling period specified in 40 CFR 265 Subpart F is 1 year. However, the background sampling period for the FMPC extended over 16 months. After initial background concentrations were established, DOE collected samples on a semiannual basis.



Explanation:

- Single Well Location
- Cluster Well Location
- Production Well Location
- IT Well Location

WELL LOCATIONS

FIGURE 8

FMPC COMPREHENSIVE MONITORING EVALUATION
ORIGINAL RCRA DETECTION MONITORING SYSTEM
CREATED: 7/28/89 | REVISED: 7/28/89 | FMPC.F8.DWG
PRC ENVIRONMENTAL MANAGEMENT, INC.

NOTE: REPRODUCED FROM D.O.E. 1987(b).

While conducting its detection monitoring program of Waste Pit No. 4, DOE submitted six RCRA Ground Water Monitoring Reports. Each report contains conclusion regarding the groundwater quality near Waste Pit No. 4. Some of these conclusion are presented below for sulfates, uranium, and VOCs.

Round 3 (DOE, 1987b):

"As with radionuclides, the presence of these constituents (sulfate and chloride) is an indication that Pit 4 may be influencing the shallow ground water."

"The presence of these radionuclides (uranium) is an indication that Pit 4 may be influencing the shallow ground water."

"This is the first time VOCs have been detected in these wells (MW-19TP and MW-20TP) and the significant of these results cannot be evaluated at this time."

Round 4 (DOE, 1987e):

"As with radionuclides, the presence of these constituents (sulfate and chloride) is an indication that Pit 4 may be influencing the shallow ground-water."

"These results are consistent with data gathered during previous sampling rounds. The presence of uranium is an indication that Pit 4 may be influencing the shallow ground water."

"This is the third time low concentrations of VOC have been detected in well MW-19TP. This may be an indication that MW-19TP is receiving ground water contain low concentrations of VOCs from Pit 4."

Round 5 (DOE, 1987c):

"The presence of these constituents (chloride and sulfate) is another indication that Pit 4 may be influencing shallow ground water."

"Uranium values in wells MW-19TP, 21TP, and 22TP are the highest of all wells monitored . . . As with chloride and sulfates, this is another indication that Pit 4 is influencing shallow ground water."

"This is the fourth time low concentrations of VOC's have been detected in this well (MW-19TP). This is a clear indication that MW-19TP is receiving ground water containing low concentrations of VOCs from Pit 4."

The conclusions become more definite through the sampling rounds that Waste Pit No. 4 is affecting the shallow ground water quality.

DOE conducted its statistical analysis of indicator parameters after its first semiannual sampling period. The mean and variance of each indicator parameter for the upgradient wells were calculated and submitted to U.S. EPA with the round 5 results. The statistical calculations were originally conducted at the 0.05 level of significance (instead of the 0.01 level of significance as specified in 40 CFR 265); however, downgradient results compared to background at either significant level would have revealed statistically significant changes in ground-water quality.

The RCRA reporting requirements applicable to the FMPC detection monitoring program include (1) the notification of U.S. EPA that the facility may be affecting the ground-water quality followed by implementation of a ground-water assessment program and (2) the separate identification of each well in the detection network well having concentrations that exceed the U.S. EPA Interim Primary Drinking Water Standards listed in Appendix III to 40 CFR 265 Subpart F. DOE satisfied both of these requirements. DOE notified U.S. EPA on November 13, 1987, of a statistically significant change in the ground-water quality. Also, each of the ground-water monitoring reports separately identifies each well and the parameters that exceed the standards set in Appendix III to 40 CFR 265 Subpart F.

5.1.1 RCRA DETECTION MONITORING WELL LOCATION

The initial RCRA detection monitoring system consisted of four groups of wells. These wells are identified on Figure 8 and described below:

- Five shallow wells completed in the till in close proximity to Waste Pit No. 4 (well MW-12 (upgradient), and wells MW-19TP, MW-21TP, MW-22TP, and OS 1A).
- Fourteen wells completed in the sand and gravel aquifer and located within the FMPC boundaries. The majority of the wells are in the waste pit area (wells MW-1s, MW1d, MW-3, MW-4, MW-5, MW-8s, MW-8d, MW-10, MW-13s, MW-13d, MW-19s, MW19d, MW21s, and MW-22s).
- Three plant production wells completed in the deeper portion of the sand and gravel aquifer (wells P-1, P-2, and P-3).

- Eighteen monitoring wells and four water supply wells completed in the sand and gravel aquifer outside the FMPC boundaries (wells SW-2 (upgradient), MW-9, MW-11, MW14s, MW-14d, MW-15s, MW-16s, MW-16d, MW-17s, MW-17d, MW-18s, MW-18d, MW20s, MW20d, OS-1, HK-15d, OS-2, and 0S-3).

The rationale for the number and locations of wells is not described in the RCRA Sampling and Analysis Plan (DOE, 1987b). As shown on Figure 8, wells at locations 1, 21, 19, and 22 are the only wells close enough to immediately detect a release from Waste Pit No. 4. In addition, the purpose of the other wells, which can be affected by other sources of contamination, is not explained. The location of the detection monitoring wells was adequate, however, to immediately detect a release from the regulated unit because RCRA hazardous constituents and radionuclide contamination was detected in each of the first six sampling rounds. After the contamination was detected, DOE continued to collect the initial background samples on a quarterly basis before conducting a statistical comparison (as required by 40 CFR 265 Subpart F). DOE conducted the statistical comparison after the first semiannual sampling event (round 5), to confirm that statistically significant changes in ground-water quality occurred and that Waste Pit No. 4 may be affecting the ground water (DOE, 1987c).

5.1.2 MONITORING WELL CONSTRUCTION

The construction details of the detection monitoring wells were not available for review. The inspector requested DOE to furnish all boring and well completion logs for the RCRA ground-water program. However, DOE submitted borelogs and well completion logs for only a portion of the borings and wells used in the RI/FS and assessment monitoring programs.

Based on the available information, several technical deficiencies and regulatory violations were identified:

- The upgradient monitoring well used to compare all other wells completed in the till aquifer is "screened in the glacial till and weathered bedrock" (DOE, 1987b). Because this well is screened across two hydrogeologic units, the ground-water samples were not representative of either aquifer.

- The wells completed in the till adjacent to Waste Pit No. 4 were installed in excavated pits that were then backfilled with a backhoe (MW-TP19, MW-TP20, MW-TP21, MW-TP22). These wells have no sand pack or annular seal to maintain the integrity of the borehole.

- Several monitoring wells were constructed in such a manner that water level elevations could not be measured (DOE, 1987b).

5.2 RCRA ASSESSMENT MONITORING PROGRAM

The RCRA ground-water quality assessment program began on November 13, 1987, when DOE notified EPA that statistical comparisons had confirmed that Waste Pit No. 4 may be affecting the ground-water quality (DOE, 1987c). This section evaluates the RCRA ground-water assessment program in terms of the elements required by 40 CFR Part 265 Subpart F:

- Confirmatory sampling
- Ground-water quality assessment plan
- Quarterly monitoring for those contaminant that are affecting the ground-water quality
- Appropriate reporting

5.2.1 Confirmatory Sampling

The statistical comparison of indicator parameters collected during round 5 (first semiannual sampling round) confirmed that Waste Pit No. 4 may be affecting the ground-water quality, but no immediate confirmatory sampling was conducted as required by 40 CFR 265.93 (c)(2). Instead, DOE continued to follow the notification procedures stated in 40 CFR 265.93 (d)(1 and 2) and submitted a ground-water quality assessment program plan (GWQAPP) to U.S. EPA on November 25, 1987, within the required time frame. Even though not conducted immediately, DOE considers the next semiannual sampling (round 6) to be the confirmatory sampling round (DOE, 1989a). However, the round 6 ground-water monitoring report does not discuss split sampling or recalculating of the statistical comparison as required by 40 CFR 265.93 (c)(2).

5.2.2 Ground-Water Quality Assessment Program Plan

Because DOE determined that Waste Pit No. 4 may be affecting the ground-water quality, it submitted a GWQAPP to U.S. EPA (DOE, 1987d). U.S. EPA reviewed this document and submitted a complaint listing several technical deficiencies (U.S. EPA, 1989b). DOE responded to this complaint with a revised GWQAPP on March 23, 1989 (DOE, 1989a). U.S. EPA's comments on the original GWQAPP and DOE's responses are presented in Appendix B.

PRC reviewed the revised GWQAPP to evaluate its compliance with the four regulatory requirements as stated in 265.93 (d)(3):

- Location and depth of wells
- Sampling and analytical methods
- Evaluation procedures
- Schedule of implementation

5.2.2.1 Monitoring Well Location

The revised GWQAPP states that 43 monitoring wells will be used in the assessment program. These wells are listed in Table 3 and shown on Figure 9. As shown on Figure 9, the till aquifer is being monitored by 14 downgradient wells and two upgradient wells. The downgradient wells monitor the circumference of the waste pit area. Although not shown in Figure 9, there are a number of wells inside and outside the waste pit area not being used in the assessment monitoring program.

The location of assessment program wells screened in the upper glacial till aquifer around the perimeter of the waste pit area is not adequate for two reasons. First, they are too far from the regulated unit to monitor any releases from the unit or determine the concentration of contaminants throughout the plume (265.93(d)(4)(i)). Second, since the contaminant plume extends beyond these wells, they are not located properly to determine the extent of contamination (265.93(d)(4)(ii)).

The rationale DOE gives for locating the till aquifer wells at the perimeter of the waste pit area is that several of the waste pits have similar materials in them and that no indicator constituent unique to Waste Pit No. 4 could be identified from the CIS characterization (DOE, 1989a). In addition, DOE stated that it has not made a determination if RCRA hazardous constituents have been released from Waste Pit No. 4; and therefore, it is conducting quarterly monitoring of wells completed in the till unit located around the parameter of the waste pit area (DOE, 1989g). This plan is not adequate because; (1) the wells are too distant from Waste Pit No. 4 to determine if it is releasing RCRA hazardous constituents into the ground water (which well 19TP has already detected, but not included in the present assessment monitoring network), and (2) DOE, in its first 2 assessment sampling rounds did not analyze ground water samples for VOCs, a major class of RCRA hazardous constituents.

The location of assessment monitoring wells around the perimeter of the waste pit area is not adequate to determine if hazardous constituents have entered the ground water. A review of the existing data indicates:

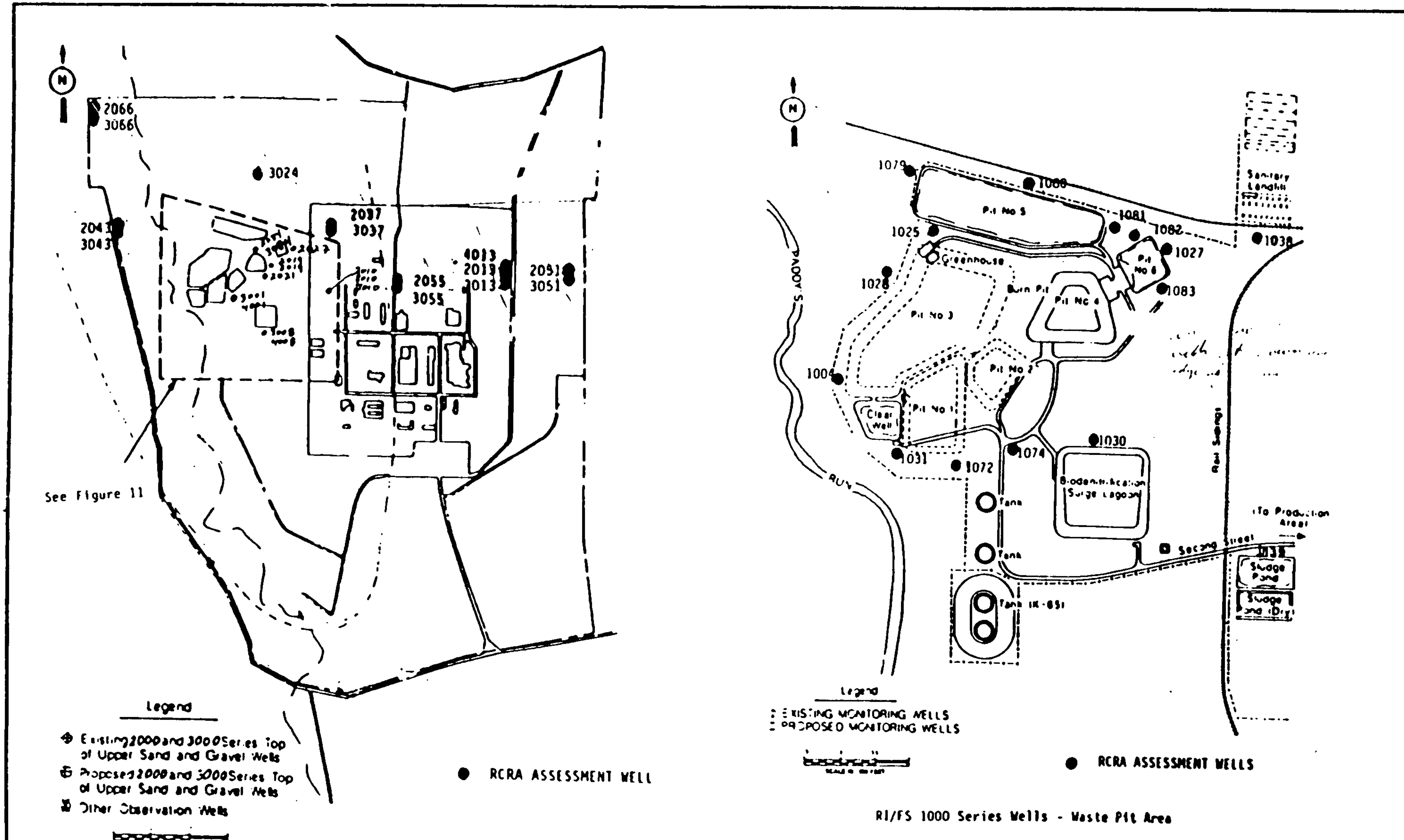
TABLE 3

SELECTED RI/FS WELLS AND SITE-SPECIFIC PARAMETERS FOR THE RCRA ASSESSMENT PROGRAM

Parameters	Rationale	Upgradient Till Wells
Cobalt	A	1024
Beryllium	A	1052
Zinc	A	
Vanadium	A	Downgradient Till Wells
Nickel	A	
Copper	A	1027
Magnesium	A	1080
Calcium	A	1079
Aluminum	A	1004
Barium	A	1074
Chromium	A	1031
Lead	A	1028
Silver	A.	1072
Iron	A	1030
Fluoride	A	1038
Nitrate	A,B	1081
Chloride	A,B	1083
Sulfate	A,B	1082
pH	I	1025
Conductivity	I	
TOC	I	Upgradient Sand & Gravel Wells
TOX	I	
Tetrachloroethene	A	2066/3066
Methylene Chloride	B	2043/3043
Dichloroethane	B	
Acetone	B	Downgradient Sand & Gravel Wells
Trichloroethene	C	
Toluene	B	3001/4001
Total Uranium	A	2084/3084
Uranium-234	A	2021
Uranium-235	A	2019/3019
Uranium-238	A	2027
Thorium-228	A	2010/3010/4010
Thorium-230	A	2013/3013/4012
Technetium-99	A	2051/3051
		2055/3055
Organic Phosphate	A	3008/4008
PCB	A	3024
		2037/3037

A Major constituent of Waste Pit No. 4.
B Constituent found in waste pit area ground water.
C Consistent of Waste Pit No. 4.
I Ground Water Indicator Parameter.

Source: DOE 1989a.



RI/FS 2000, 3000 and 4000 Series Wells - FMPC Site

RI/FS 1000 Series Wells - Waste Pit Area

FIGURE 9

FMPC COMPREHENSIVE MONITORING EVALUATION		
RI/FS WELLS SELECTED FOR THE RCRA ASSESMENT PROGRAM		
CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F9
PRC ENVIRONMENTAL MANAGEMENT, INC.		

NOTE: REPRODUCED FROM D.O.E.1989(a).

- A persistent ground-water high centered around Waste Pit No. 4.
- Consistent occurrence of VOCs in MW-19TP in rounds 2 through 6 of detection monitoring and round 1 of assessment monitoring (samples from this well were not analyzed for VOCs in round 2 of the assessment).
- The highest total uranium and total thorium concentrations are from monitoring wells adjacent to Waste Pit No. 4 (MW-TP19, MW-TP-21, and MW-TP22).
- The highest concentrations of sulfate in the ground water are centered around Waste Pit No. 4.
- Iso-concentration contours of sulfate and uranium exhibit a similar pattern in the Waste Pit No. 4 area.

These data indicate that Waste Pit No. 4 may be the major source of radionuclide and RCRA hazardous constituent contamination in the waste pit area should be assessed more closely. Additionally, this information will be vital to any contaminant transport modeling effort conducted to interpret the data.

The current assessment well network for the till aquifer cannot define the extent of contamination. Table 4 lists the monitoring wells completed in the till unit and the total uranium concentrations for the first two rounds. Although uranium is not a RCRA hazardous constituent; all solid waste (including leachate) originating from a RCRA regulated unit which has RCRA hazardous waste disposed of in it are hazardous wastes subject to assessment monitoring (261.3(c)(2)(i)). Waste pit No. 4 has RCRA listed hazardous waste (VOCs) and characteristic wastes; and monitoring well 19TP is "receiving ground water containing low concentrations of VOCs from Pit 4" (DOE, 1987c). Therefore, the extent of uranium concentration originating from Waste Pit No. 4 should be part of the GWQAPP. The extent of contamination either from the waste pit area or specifically from Waste Pit No. 4 is difficult to determine because of the several potential sources of radionuclide contamination at the FMPC. However, because significant contamination is present in the most downgradient assessment wells, the monitoring network is inadequate to define the extent of contamination either originating from the waste pit area or specifically from Waste Pit No. 4.

TABLE 4

ASSESSMENT WELL URANIUM RESULTS
(Glacial Aquifer Wells)

Well	Listed in Annual Report[a] Round 1	Listed in Annual Report[a] Round 2	Listed in RI/FS Database	Uranium Concentration (ug/L) Round 1	Uranium Concentration (ug/L) Round 2
1079	N	N	Y	2	2
1025	N	N	Y	8	9
1028	N	N	N	NR[(b)]	NR
1004	N	N	N	NR	NR
1031	N	N	N*	3	NR
1074	N	N	N*	4	NR
1072	N	N	N	NR	NR
1030	N	N	N	NR	NR
1083	Y	Y	Y	94	139
1027	Y	Y	Y	1	<1
1038	N	N	N*	5	NR
1082	N	N	N*	1,137	NR
1081	N	N	N*	26	NR
1080	N	N	Y	7	6

Notes:

a Y = Yes; N = No if analytical result is listed in the GWQAPP Annual Report. If N, then the result was extracted from the RI/FS database if possible.

b NR -- Not reported.

* Reported in RI/FS database for Round 1, but not Round 2, of assessment monitoring.

The number and location of assessment wells in the sand and gravel aquifer (3000- and 4000-series wells) does not appear adequate to define the edge of the contaminant plume in this aquifer, especially for the 3000-series wells. This conclusion is based on the limited data supplied in the GWQAPP annual report which includes the analysis of only 14 of the 23 downgradient 2000-, 3000-, and 4000-series wells. In addition, VOCs were not analyzed in either of the first two sampling rounds as required by the GWQAPP. Since the contaminant plume extends north, south, and east beyond the limits of the assessment wells, the inclusion of several RI/FS wells would add valuable information in terms of defining the contamination boundaries.

All the assessment monitoring wells were adequately constructed to yield representative ground-water samples. Several wells in the waste pit area (MW-TP19, MW-TP21, and MW-TP22) that are not part of the assessment monitoring program but can yield valuable information. Although these other wells were constructed in a manner such that ground-water samples may not be representative of ground-water quality, they are the only wells in the immediate area of Waste Pit No. 4, and the data must be used until properly constructed wells at these locations can be installed and sampled.

The sampling and analysis plan (SAP) used in assessment monitoring is essentially the same as that used for the RI/FS sampling. The sampling and analysis plan is generally adequate to meet the technical objectives of the GWQAPP. With the exception that there are no specific sampling procedures for collecting TOX and TOC sample fractions.

PRC observed the sampling of assessment monitoring wells to check the field procedures against those established in the sampling and analysis plan of the GWQAPP. In general, the field sampling procedures were carried out with an acceptable level of competence. The sampling technicians were careful to keep decontaminated equipment wrapped in plastic or out of contact with other equipment until used for sampling. Good field notes were taken on standardized forms consistent with the sampling and analysis plan and RI/FS QAPP.

Some technical weaknesses were observed during the inspection. However, the degree to which they affected the analytical results is uncertain. The weaknesses are as follows:

- Methods used to decontaminate the submersible pump and bailers meet the requirements in the SAP but were hastily conducted, equipment (bailers, pumps, etc.) was not disassembled, decontaminated, and reassembled. However, only one field equipment rinsate blank from the first two sampling rounds detected quantifiable amounts of uranium.

- Water level measurements were read off a tape graduated to the nearest 0.05 foot and estimated to the nearest 0.01 foot. However, the water levels in each aquifer vary considerably (several feet), so this measurement interval may be adequate.
- After water samples for inorganic parameters were collected, a Teflon bailer was used to collect the organic parameter samples. The bailer was allowed to free-fall at least 20 feet down the inside of the well before it hit the water table. In addition, the check ball did not seat properly, at one well, thus allowing water to cascade back down the well. After several aborted attempts to seat the check ball properly, the technician vigorously shook the bailer in the well just below the water table. This shaking could have aerated the water sample causing organic compounds to volatilize.
- Only two rinsate and duplicate samples were collected instead of the required three as specified in the SAP. The SAP requires that one QC sample be collected for every 20 samples or fraction thereof (43 wells were sampled, requiring that three sets of QC samples be collected).

5.2.2.2 Evaluation Procedures

The GWQAPP discusses the evaluation procedures in very general terms, such as using downgradient and upgradient samples for possible statistical comparisons. The GWQAPP also mentions the flow and transport models used in the site-wide RI/FS, but does not specify how these will be used in the assessment program.

5.2.2.3 Schedule of Implementation

The GWQAPP contains a schedule that includes quarterly sampling of assessment monitoring wells until the final remediation of the waste pit area in late 1992 or early 1993. The schedule also states that a post-closure monitoring plan will be developed within 90 days after the record of decision is signed for the CERCLA action in the waste pit area.

The schedule, although meeting the regulatory requirements of 265.93(d)(3)(iv), is not sufficient to meet the intent of the regulations. The schedule implies that DOE has no specific plans to evaluate the contamination from Waste Pit No. 4, and it does not include interim milestones necessary to make a first determination if RCRA hazardous constituents have entered the ground water or to assess the rate, extent, and concentrations of contamination as soon as technically feasible. During the field inspection, the FMPC representatives were asked specifically if DOE had plans to assess, monitor, and remediate Waste Pit No. 4 as a RCRA unit. The representatives stated that Waste Pit No. 4 will be assessed, monitored, and remediated along with the other units within the waste pit area under the site-wide RI/FS.

5.2.3 QUARTERLY MONITORING

DOE samples the assessment monitoring wells on a quarterly basis. The facility has completed four quarterly assessment monitoring sampling rounds. The wells and analytical parameters sampled during this required monitoring program are listed in Table 3. However, PRC had access to the results for only the first two sampling rounds. Results of rounds one and two are presented in the GWQAPP annual report (DOE, 1989c). Three areas of noncompliance were identified in terms of the quarterly monitoring.

First, the annual report does not include all the analytical results for the assessment monitoring wells. As Table 3 shows, the annual report includes results of only 2 of the designated 14 downgradient 1000- series wells. Furthermore, the annual report lists results for only 14 of 23 downgradient 2000-, 3000-, and 4000-series wells. In fact, round 2 results for total uranium were found for only 4 of the 14 downgradient 1000-series wells in the RI/FS database, which contains all of the environmental data collected at the facility, indicating that these wells were not sampled in compliance with the GWQAPP.

Second, the annual report does not list the analytical results for cobalt, beryllium, zinc, vanadium, nickel, copper, calcium, TOC, TOX, or specific radioisotopes as called for in the GWQAPP. It cannot be determined whether the wells were sampled for these parameters.

Finally, the annual report states that for many wells in both rounds, samples were not analyzed for volatile organic compounds. This class of RCRA hazardous constituents is important because they are a major constituent of Waste Pit No. 4 (DOE, 1989a), and they have been quantified in several sampling rounds from wells adjacent to Waste Pit No. 4.

5.2.4 RECORDKEEPING AND REPORTING

In assessment monitoring, DOE is required to (1) maintain records and evaluations of the GWQAPP through the end of post closure and (2) submit annual reports to U.S. EPA by March 1 of each year concerning the results of the GWQAPP. PRC did not audit the facility's files to inventory the GWQAPP records. However, U.S. EPA's files were reviewed. PRC did not find the 1987 GWQAPP annual report in U.S. EPA's files, but did find the 1988 report as described above.

6.0 COMPLIANCE STATUS SUMMARY

The primary objective of the CME inspection was to evaluate the facility's compliance with the regulations in 40 CFR 265 Subpart F. The CME focused on evaluating the ground-water quality assessment program, but also examined the detection monitoring program. The compliance status is defined in terms of the facility's regulatory status, technical deficiencies, and regulatory violations.

6.1 FACILITY REGULATORY STATUS

The FMPC is a RCRA interim status facility that disposed of hazardous waste in a land based unit. The regulated unit of interest (Waste Pit No. 4) was in detection monitoring until November 1987. After November 1987, Waste Pit No. 4 entered assessment monitoring. DOE performed an interim closure action on the waste pit by placing a synthetic cap over the waste pit. DOE plans to conduct final closure of this RCRA unit as part of a remedial action to be conducted on all the waste pits under the site-wide RF/FS.

6.2 TECHNICAL DEFICIENCIES AND REGULATORY VIOLATIONS

For the purpose of this report, "technical deficiencies" are those practices and procedures not specifically prohibited by the regulations in 40 CFR 265, Subpart F, and yet not adequate to meet the spirit or intent of the regulations. Additionally, practices are termed deficient if they are not equivalent to preferred methods recommended in guidance documents referenced in 40 CFR 265, Subpart F, or the Technical Enforcement Guidance Document (U.S. EPA, 1986). Technical deficiencies, if left unaddressed, may result in regulatory violations.

The term "violation" is used for practices that do not comply with the regulations set forth in 40 CFR 265, Subpart F. Violations can be directly referenced to specific requirements of the regulations.

6.2.1 Technical Deficiencies

PRC identified several technical deficiencies during the file review and field inspection. These are listed below:

- DOE did not take prompt action in initiating its assessment monitoring program when empirical comparison of first round results from up- and downgradient wells indicated that Waste Pit No. 4 may be affecting the ground-water quality. By the second sampling round, empirical comparison between up- and downgradient wells strongly indicated that Waste Pit No. 4 was affecting the ground-water quality in the pit area. However, DOE continued its detection monitoring program to establish initial background mean and variance concentrations. DOE did not start the statistical comparison until after the first semiannual sampling round in May 1987. In November 1987, DOE notified U.S. EPA that Waste Pit No. 4 may be affecting the ground-water quality and that an assessment program should begin. However, this notification was 26 months after initial sampling suggested that ground-water contamination may be originating at Waste Pit No. 4.

- The technique used to collect ground-water samples for VOC analysis severely agitated the sample and may have resulted in the loss of VOCs.

- Only two rinsate and duplicate samples were collected instead of the three required in the SAP. The SAP requires that one QC sample be collected for every 20 samples or fraction thereof (43 wells were sampled, requiring three sets of QC samples).

- The GWQAPP schedule does not contain milestones specific to the assessment of Waste Pit No. 4. The schedule presented in the GWQAPP indicates that Waste Pit No. 4 will be assessed, monitored, and remediated as part of the site-wide RI/FS. Milestones for assessing ground-water contamination from a regulated unit must be specific enough for U.S. EPA to monitor the progress of the assessment.

- The GWQAPP relies on regional data to establish properties of the sand and gravel aquifer.

- A 20-foot unsaturated zone exists between the base of the perched till aquifer and the water table of the buried valley sand and gravel aquifer. The GWQAPP does not address the quantity or quality of ground water leaking through the till and recharging the lower aquifer (nor does the RI/FS work plan).

- The upgradient monitoring well for the till aquifer detection monitoring system is screened across two geologic units and is not constructed such that ground-water samples can be collected from the appropriate flow zone.

- The hydrogeology of the glacial till aquifer and subsequently ground water flow zones has not been adequately characterized. The four wells tested for hydraulic conductivity in the waste pit area do not provide sufficient data to characterize this unit. In addition, monthly variation in ground-water flow has not been addressed.

6.2.2 Regulatory Violations

PRC identified the following regulatory violations during the technical review of documents:

1 • The initial background period continued over 16 months, not the 12 months specified (265.92(c)(1)) (OAC 3745-65-92(D)(1)).

2 • The original detection monitoring wells completed in the till (TP-designated wells) were constructed in test pits but not cased in a manner that would maintain the integrity of the monitoring well (265.91(c)) (OAC 3745-65-91(C)).

3 • During detection monitoring, water level measurements were not taken at each well for each sampling period (265.92(e)) (OAC 3745-65-92(E)).

4 • DOE did not immediately resample the ground water after the first semiannual detection monitoring period (round 5), when statistically significant changes were detected in the water quality. The wells were resampled in round 6, but there is no indication that samples were split or that statistical determinations were made (265.93(c)(2)) (OAC 3745-65-93(C)(2)).

5 • The assessment monitoring wells selected to monitor the till aquifer are located at the perimeter of the waste pit area, but not adjacent to Waste Pit No. 4. These perimeter wells are not sufficient to determine the concentrations of hazardous constituents (including RCRA hazardous constituents or other hazardous constituents of concern (i.e., uranium) in the ground water (265.93(d)(4)(ii)) (OAC 3745-65-93(D)(4)(b)) or characterize the contaminant plume (270.14(c)(4)) (OAC 3745-70-14(C)(4)).

6 • The locations of the assessment monitoring wells completed in the till aquifer do not define the extent of the contaminant plume; no additional plans are presented in the GWQAPP or annual report for investigating the outer boundary of the plume past the perimeter wells (265.93(d)(4)(i)) (OAC 3745-65-93(D)(4)(a)).

7 • No violation concerning the placement of the sand and gravel aquifer wells can be identified due to the limited data supplied.

8 • The GWQAPP does not specify sampling or analytical procedures for all constituents, specifically TOX and TOC (265.93(d)(3)(ii)) (OAC 3745-65-93(D)(3)(b)).

9 • DOE failed to adequately implement portions of the assessment program by not conducting the required analyses in sampling rounds 1 and 2 as specified in the GWQAPP (265.93(d)(4)) (OAC 3745-65-93(D)(4)).

10 • The annual report for the assessment program did not include the analytical results for several wells listed in the GWQAPP (265.94(b)(2)) (OAC 3745-65-94(B)(2)).

11 • Hazardous Waste were placed in the Clearwell, Waste Pit No. 5, and the biodinitrification lagoon after November 1981; therefore, DOE failed to conduct proper 40 CFR 265 activities and is in violation of these regulations.

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U.S. EPA, 1989a. Personal communication between Catherine McCord, U.S. EPA enforcement agent, and Edward Schuessler, PRC. July 18, 1989.

U.S. EPA, 1989b. Complaint, Findings of Violation and Compliance Order. U.S. Department of Energy Feed Materials Production Center. February 9, 1989.

USGS 1981. 7.5 Minute USGS Topographic Map.

APPENDIX A

CHEMICAL AND RADIOLOGICAL ANALYSIS OF WASTE STORAGE PITS

Pit One

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	1702.92	20223.31	MG/KG	6
ARSENIC, TOTAL	14.46	15.20	MG/KG	2
BARIUM, EP LEACHATE	1018.00	3743.00	UG/L	4
BARIUM, TOTAL	116.48	395.37	MG/KG	6
BERYLLIUM, TOTAL	2.03	2.20	MG/KG	2
CADMIUM, TOTAL	1.46	4.96	MG/KG	3
CALCIUM, TOTAL	4755.83	192497.97	MG/KG	6
CHROMIUM, TOTAL	6.35	46.33	MG/KG	5
COBALT, TOTAL	27.85	27.85	MG/KG	1
COPPER, TOTAL	19.05	160.79	MG/KG	6
IRON, TOTAL	1832.56	19687.98	MG/KG	6
LEAD, EP LEACHATE	660.00	660.00	UG/L	1
LEAD, TOTAL	4.98	89.92	MG/KG	6
MAGNESIUM, TOTAL	7613.78	36957.20	MG/KG	6
MANGANESE, TOTAL	144.81	2914.70	MG/KG	6
MERCURY, TOTAL	.26	.36	MG/KG	2
NICKEL, TOTAL	9.22	64.53	MG/KG	5
POTASSIUM, TOTAL	165.48	2564.10	MG/KG	6
SILVER, TOTAL	2.25	33.09	MG/KG	3
SODIUM, TOTAL	386.12	3638.58	MG/KG	5
VANADIUM, TOTAL	13.74	66.74	MG/KG	5
ZINC, TOTAL	6.09	57.91	MG/KG	4

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Pit One

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
4,4-DDT	1600.00	1600.00	UG/KG	1
AROCLOR-1248	3500.00	3500.00	UG/KG	1
AROCLOR-1254	720.00	10000.00	UG/KG	4
AROCLOR-1260	7000.00	7000.00	UG/KG	1
CHLOROFORM	210.00	210.00	UG/KG	1
CHRYSENE	510.00	510.00	UG/KG	1
PHENANTHRENE	770.00	2300.00	UG/KG	2

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Pit One

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	.20	1.10	PCI/G	5
NP-237	.10	.30	PCI/G	5
PU-238	.10	.10	PCI/G	5
PU-239/240	.10	.10	PCI/G	5
RA-226	12.00	60.20	PCI/G	5
RU-106	2.00	4.00	PCI/G	5
SR-90	.30	.60	PCI/G	5
TC-99	1.00	15.00	PCI/G	5
TH-228	1.80	18.00	PCI/G	5
TH-230	122.00	1980.00	PCI/G	5
TH-232	1.80	17.00	PCI/G	5
U-234	244.00	1180.00	PCI/G	5
U-235	16.00	151.00	PCI/G	5
U-238	360.00	6980.00	PCI/G	5

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Pit Two

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	7242.30	22421.77	MG/KG	5
ARSENIC, TOTAL	2.75	10.06	MG/KG	4
BARIUM, EP LEACHATE	4221.00	9458.00	UG/L	3
BARIUM, TOTAL	62.37	208.49	MG/KG	5
BERYLLIUM, TOTAL	1.87	8.92	MG/KG	3
CADMIUM, TOTAL	3.04	9.59	MG/KG	5
CALCIUM, TOTAL	34414.38	80154.23	MG/KG	5
CHROMIUM, TOTAL	16.17	91.26	MG/KG	5
COBALT, TOTAL	13.63	450.56	MG/KG	4
COPPER, TOTAL	26.18	329.06	MG/KG	5
IRON, TOTAL	13265.46	24037.73	MG/KG	5
LEAD, TOTAL	20.70	190.29	MG/KG	5
MAGNESIUM, TOTAL	8884.98	26676.81	MG/KG	5
MANGANESE, TOTAL	495.43	916.57	MG/KG	5
MERCURY, EP LEACHATE	.27	.27	UG/L	1
MERCURY, TOTAL	.22	.70	MG/KG	4
NICKEL, TOTAL	28.75	608.90	MG/KG	5
POTASSIUM, TOTAL	667.42	4318.50	MG/KG	5
SELENIUM, TOTAL	1.59	10.19	MG/KG	3
SILVER, TOTAL	5.90	23.16	MG/KG	3
SODIUM, TOTAL	410.72	2303.20	MG/KG	5
VANADIUM, TOTAL	26.95	105.94	MG/KG	5
ZINC, TOTAL	53.58	3247.15	MG/KG	5

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Pit Two

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
2-METHYLNAPHTHALENE	7000.00	7000.00	UG/KG	1
4,4-DDT	580.00	1400.00	UG/KG	2
4-CHLOROPHENYL-PHENYLETHER	62000.00	62000.00	UG/KG	1
ACENAPHTHENE	43000.00	43000.00	UG/KG	1
ANTHRACENE	120000.00	120000.00	UG/KG	1
AROCLOR-1248	321.00	321.00	UG/KG	1
AROCLOR-1254	323.00	323.00	UG/KG	1
AROCLOR-1260	740.00	1800.00	UG/KG	2
BENZO(A)ANTHRACENE	860.00	180000.00	UG/KG	3
BENZO(A)PYRENE	700.00	140000.00	UG/KG	3
BENZO(B)FLUORANTHENE	760.00	110000.00	UG/KG	2
BENZO(G,H,I)PERYLENE	42000.00	42000.00	UG/KG	1
BENZO(K)FLUORANTHENE	600.00	120000.00	UG/KG	3
CHRYSENE	920.00	180000.00	UG/KG	2
DIBENZOFURAN	36000.00	36000.00	UG/KG	1
FLUORANTHENE	590.00	460000.00	UG/KG	3
FLUORENE	62000.00	62000.00	UG/KG	1
INDENO(1,2,3-CD)PYRENE	46000.00	46000.00	UG/KG	1
NAPHTHALENE	16000.00	16000.00	UG/KG	1
PHENANTHRENE	1700.00	370000.00	UG/KG	2
PYRENE	1600.00	310000.00	UG/KG	2
VINYL CHLORIDE	670.00	670.00	UG/KG	1

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Pit Two

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	.20	3.60	PCI/G	5
NP-237	.10	.40	PCI/G	5
PU-238	.10	.10	PCI/G	5
PU-239/240	.05	.60	PCI/G	5
RA-226	12.20	412.00	PCI/G	5
RU-106	2.00	35.00	PCI/G	5
SR-90	.30	1.00	PCI/G	5
TC-99	1.00	618.00	PCI/G	5
TH-228	.30	73.00	PCI/G	5
TH-230	1.20	3980.00	PCI/G	5
TH-232	.10	88.00	PCI/G	5
U-234	39.00	18200.00	PCI/G	5
U-235	1.00	8780.00	PCI/G	5
U-238	53.00	17900.00	PCI/G	5

Pit Three

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	8219.61	64100.08	MG/KG	7
ARSENIC, EP LEACHATE	514.00	3116.00	UG/L	4
ARSENIC, TOTAL	15.41	3049.06	MG/KG	7
BARIUM, TOTAL	251.19	14354.90	MG/KG	7
BERYLLIUM, TOTAL	2.76	24.01	MG/KG	6
CADMIUM, TOTAL	1.91	12.65	MG/KG	7
CALCIUM, TOTAL	53183.03	178241.20	MG/KG	7
CHROMIUM, TOTAL	16.38	151.84	MG/KG	7
COPPER, TOTAL	79.50	2332.66	MG/KG	7
IRON, TOTAL	10730.37	26919.20	MG/KG	7
LEAD, TOTAL	25.57	613.21	MG/KG	7
MAGNESIUM, TOTAL	21492.80	51570.00	MG/KG	7
MANGANESE, TOTAL	407.29	10570.89	MG/KG	7
MERCURY, EP LEACHATE	.25	7.23	UG/L	2
MERCURY, TOTAL	.45	4.01	MG/KG	4
NICKEL, TOTAL	22.34	503.97	MG/KG	7
POTASSIUM, TOTAL	810.24	2894.00	MG/KG	7
SELENIUM, EP LEACHATE	257.00	257.00	UG/L	1
SELENIUM, TOTAL	1.29	89.80	MG/KG	4
SILVER, TOTAL	3.54	8.11	MG/KG	4
SODIUM, TOTAL	1191.68	7640.00	MG/KG	7
SULFIDE	1.95	1.95	MG/KG	1
THALLIUM, TOTAL	5.89	12.21	MG/KG	2
VANADIUM, TOTAL	50.06	9695.51	MG/KG	7
ZINC, TOTAL	37.87	311.19	MG/KG	7

Pit Three

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	.20	6.00	PCI/G	7
NP-237	.10	2.10	PCI/G	7
PU-238	.05	1.00	PCI/G	7
PU-239/240	.05	14.00	PCI/G	7
RA-226	3.10	369.00	PCI/G	7
RU-106	2.00	35.00	PCI/G	7
SR-90	.50	26.00	PCI/G	7
TC-99	1.00	1110.00	PCI/G	7
TH-228	1.00	82.00	PCI/G	7
TH-230	15.00	21900.00	PCI/G	7
TH-232	1.00	121.00	PCI/G	7
U-234	27.00	475.00	PCI/G	7
U-235	2.50	21.00	PCI/G	7
U-238	134.00	1380.00	PCI/G	7

Pit Four

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	3645.60	10325.99	MG/KG	5
ARSENIC, EP LEACHATE	582.00	582.00	UG/L	1
ARSENIC, TOTAL	4.63	4.63	MG/KG	1
BARIUM, EP LEACHATE	1023.00	81470.00	UG/L	3
BARIUM, TOTAL	444.03	6668.76	MG/KG	5
BERYLLIUM, TOTAL	13.30	13.30	MG/KG	1
CADMIUM, EP LEACHATE	141.00	141.00	UG/L	1
CADMIUM, TOTAL	1.92	28.72	MG/KG	3
CALCIUM, TOTAL	14252.84	61252.80	MG/KG	5
CHROMIUM, TOTAL	7.92	93.63	MG/KG	5
COBALT, TOTAL	84.06	84.06	MG/KG	1
COPPER, TOTAL	20.35	187.73	MG/KG	5
FLUORIDE	47812.36	124576.13	MG/KG	4
IRON, TOTAL	3045.60	16127.52	MG/KG	5
LEAD, EP LEACHATE	753.00	753.00	UG/L	1
LEAD, TOTAL	13.71	62.51	MG/KG	5
MAGNESIUM, TOTAL	11423.80	24251.31	MG/KG	5
MANGANESE, TOTAL	1383.43	3596.38	MG/KG	5
MERCURY, EP LEACHATE	1.06	1.06	UG/L	1
MERCURY, TOTAL	.18	.63	MG/KG	3
NICKEL, TOTAL	20.67	49.73	MG/KG	3
PHENOL	.43	.83	MG/KG	3
POTASSIUM, TOTAL	303.10	1920.00	MG/KG	4
SILVER, EP LEACHATE	2767.00	2767.00	UG/L	1
SILVER, TOTAL	2.59	443.65	MG/KG	4
SODIUM, TOTAL	254.90	1237.55	MG/KG	5
SULFIDE	.50	.50	MG/KG	1
VANADIUM, TOTAL	13.85	235.36	MG/KG	4
ZINC, TOTAL	13.92	84.06	MG/KG	5

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Pit Four

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
ANTHRACENE	510.00	510.00	UG/KG	1
AROCLOR-1242	99.00	1034.00	UG/KG	2
AROCLOR-1248	460.00	854.00	UG/KG	2
AROCLOR-1254	1008.00	1008.00	UG/KG	1
BENZO(A)ANTHRACENE	750.00	750.00	UG/KG	1
BENZO(A)PYRENE	550.00	550.00	UG/KG	1
BENZO(B)FLUORANTHENE	510.00	510.00	UG/KG	1
BENZO(K)FLUORANTHENE	560.00	560.00	UG/KG	1
CHLOROFORM	430.00	1300.00	UG/KG	2
CHRYSENE	760.00	760.00	UG/KG	2
ETHYL PARATHION	82.00	860.00	UG/KG	3
FLUORANTHENE	1000.00	2200.00	UG/KG	3
MALATHION	670.00	670.00	UG/KG	1
METHYL PARATHION	370.00	2100.00	UG/KG	3
PHENANTHRENE	1000.00	2100.00	UG/KG	3
PYRENE	670.00	1400.00	UG/KG	3
TETRACHLOROETHENE	530.00	30000.00	UG/KG	2
TRICHLOROETHENE	300.00	300.00	UG/KG	1

Pit Four

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	.20	.50	PCI/G	4
NP-237	.10	.40	PCI/G	4
PU-238	.10	.50	PCI/G	4
PU-239/240	.10	.40	PCI/G	4
RA-226	5.00	20.00	PCI/G	4
RU-106	2.00	4.00	PCI/G	4
SR-90	.40	1.00	PCI/G	4
TC-99	6.80	225.00	PCI/G	4
TH-228	.30	24.00	PCI/G	4
TH-230	2.20	566.00	PCI/G	4
TH-232	.30	21.00	PCI/G	4
U-234	149.00	2320.00	PCI/G	4
U-235	35.00	426.00	PCI/G	4
U-238	509.00	15800.00	PCI/G	4

Pit Five

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	6373.77	15400.00	MG/KG	6
ANTIMONY, TOTAL	28.00	28.00	MG/KG	1
ARSENIC, EP LEACHATE	516.00	516.00	UG/L	1
ARSENIC, TOTAL	139.00	2800.00	MG/KG	6
BARIUM, EP LEACHATE	2260.00	3171.00	UG/L	2
BARIUM, TOTAL	15800.00	36938.95	MG/KG	7
BERYLLIUM, TOTAL	2.85	18.00	MG/KG	5
BERYLLIUM,TOTAL	8.80	8.80	MG/KG	1
CADMIUM, TOTAL	17.00	17.00	MG/KG	1
CADMIUM,TOTAL	4.40	4.40	MG/KG	1
CALCIUM, TOTAL	116000.00	206144.40	MG/KG	6
CHROMIUM, TOTAL	25.66	223.29	MG/KG	6
COBALT, TOTAL	16.00	43.99	MG/KG	3
COPPER, TOTAL	672.21	3370.00	MG/KG	6
IRON, TOTAL	10979.43	17900.00	MG/KG	6
LEAD, TOTAL	59.50	236.00	MG/KG	6
MAGNESIUM, TOTAL	25201.76	63200.00	MG/KG	6
MANGANESE, TOTAL	346.29	4740.00	MG/KG	6
MERCURY, EP LEACHATE	1.90	6.20	UG/L	3
MERCURY, TOTAL	.39	1.80	MG/KG	6
NICKEL, TOTAL	52.55	202.00	MG/KG	3
POTASSIUM, TOTAL	611.10	1490.00	MG/KG	6
SELENIUM, TOTAL	2.80	7.47	MG/KG	3
SILVER, TOTAL	8.18	9.40	MG/KG	2
SODIUM, TOTAL	1425.90	9980.00	MG/KG	6
THALIUM, TOTAL	2.80	2.80	MG/KG	1
VANADIUM, TOTAL	791.98	5380.00	MG/KG	6
ZINC, TOTAL	116.92	212.00	MG/KG	6

Pit Five

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
AROCLOR-1254	750.00	750.00	UG/KG	1

Pit Five

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	2.00	76.00	PCI/G	6
NP-237	.30	23.00	PCI/G	6
PU-238	.10	4.40	PCI/G	6
PU-239/240	.10	13.00	PCI/G	6
RA-226	235.00	999.00	PCI/G	6
RU-106	13.00	35.00	PCI/G	6
SR-90	.80	23.00	PCI/G	6
TC-99	423.00	2990.00	PCI/G	6
TH-228	41.00	191.00	PCI/G	6
TH-230	3080.00	20200.00	PCI/G	6
TH-232	21.00	90.00	PCI/G	6
U-234	310.00	1250.00	PCI/G	6
U-235	14.00	79.00	PCI/G	6
U-238	387.00	1230.00	PCI/G	6

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Pit Six

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	4730.37	4730.37	MG/KG	1
ARSENIC, TOTAL	7.61	7.61	MG/KG	1
BARIUM, EP LEACHATE	1092.00	1092.00	UG/L	1
BARIUM, TOTAL	95.22	95.22	MG/KG	1
BERYLLIUM, TOTAL	2.00	5.73	MG/KG	2
CADMIUM, EP LEACHATE	251.00	251.00	UG/L	1
CADMIUM, TOTAL	.60	5.73	MG/KG	2
CALCIUM, TOTAL	22189.54	22189.54	MG/KG	1
CHROMIUM, TOTAL	4.80	29.74	MG/KG	4
COBALT, TOTAL	26.09	26.09	MG/KG	1
COPPER, TOTAL	13.00	222.02	MG/KG	4
IRON, TOTAL	2749.88	2749.88	MG/KG	1
LEAD, EP LEACHATE	1894.00	1894.00	UG/L	1
LEAD, TOTAL	5.00	59.62	MG/KG	4
MAGNESIUM, TOTAL	32101.13	32101.13	MG/KG	1
MANGANESE, TOTAL	34.96	34.96	MG/KG	1
MERCURY, TOTAL	.03	.07	MG/KG	3
NICKEL, TOTAL	7.70	51.39	MG/KG	4
POTASSIUM, TOTAL	913.15	913.15	MG/KG	1
SILVER, EP LEACHATE	2068.00	2068.00	UG/L	1
SILVER, TOTAL	158.10	158.10	MG/KG	1
SODIUM, TOTAL	600.07	600.07	MG/KG	1
VANADIUM, TOTAL	100.18	100.18	MG/KG	1
ZINC, TOTAL	4.80	51.00	MG/KG	4

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Pit Six

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
1,1,2,2-TETRACHLOROETHANE	29000.00	29000.00	UG/KG	1

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Pit Six

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	4.00	31.00	PCI/G	4
NP-237	.90	4.50	PCI/G	4
PU-238	.40	1.40	PCI/G	4
PU-239/240	4.00	15.00	PCI/G	4
RA-226	16.00	30.00	PCI/G	4
RU-106	35.00	35.00	PCI/G	4
SR-90	.50	4.00	PCI/G	4
TC-99	84.00	164.00	PCI/G	4
TH-228	.20	2.00	PCI/G	4
TH-230	14.00	41.00	PCI/G	4
TH-232	.20	1.20	PCI/G	4
U-234	2000.00	5330.00	PCI/G	4
U-235	350.00	1750.00	PCI/G	4
U-238	12500.00	18700.00	PCI/G	4

Burn Pit

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	2911.89	11935.61	MG/KG	7
ARSENIC, TOTAL	4.38	20.91	MG/KG	4
BARIUM, EP LEACHATE	1252.00	4291.00	UG/L	7
BARIUM, TOTAL	56.23	7097.22	MG/KG	6
BERYLLIUM, TOTAL	1.45	16.38	MG/KG	2
CADMIUM, TOTAL	1.33	34.84	MG/KG	4
CALCIUM, TOTAL	10114.49	116321.92	MG/KG	7
CHROMIUM, TOTAL	7.87	87.52	MG/KG	7
COBALT, TOTAL	22.22	104.11	MG/KG	2
COPPER, TOTAL	12.25	166.54	MG/KG	7
IRON, TOTAL	3746.90	17444.92	MG/KG	7
LEAD, TOTAL	6.68	52.58	MG/KG	7
MAGNESIUM, TOTAL	3859.06	57078.97	MG/KG	7
MANGANESE, TOTAL	119.19	1717.27	MG/KG	7
MERCURY, EP LEACHATE	.21	.32	UG/L	3
MERCURY, TOTAL	.14	.24	MG/KG	3
NICKEL, TOTAL	8.91	59.73	MG/KG	5
POTASSIUM, TOTAL	485.94	1451.80	MG/KG	7
SELENIUM, TOTAL	1.91	1.91	MG/KG	1
SILVER, TOTAL	6.84	506.05	MG/KG	2
SODIUM, TOTAL	355.52	1265.14	MG/KG	5
VANADIUM, TOTAL	14.09	289.53	MG/KG	7
ZINC, TOTAL	14.53	74.66	MG/KG	7

Burn Pit

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
2-METHYLNAPHTHALENE	50.00	50.00	UG/KG	1
AROCLOR-1016	290.00	290.00	UG/KG	1
AROCLOR-1242	290.00	290.00	UG/KG	1
AROCLOR-1248	200.00	200.00	UG/KG	1
AROCLOR-1254	1957.00	2700.00	UG/KG	2
BENZO(A)ANTHRACENE	61.00	64.00	UG/KG	2
BENZO(B)FLUORANTHENE	69.00	170.00	UG/KG	4
BENZO(G,H,I)PERYLENE	85.00	85.00	UG/KG	1
CHRYSENE	73.00	77.00	UG/KG	2
ETHYLBENZENE	270.00	270.00	UG/KG	1
FLUORANTHENE	74.00	220.00	UG/KG	4
PENTACHLOROPHENOL(2)	1200.00	2600.00	UG/KG	2
PHENANTHRENE	100.00	190.00	UG/KG	3
PHENOL	650.00	650.00	UG/KG	1
PYRENE	79.00	140.00	UG/KG	3
TETRACHLOROETHENE	260.00	260.00	UG/KG	1
TOTAL XYLENES	890.00	890.00	UG/KG	1

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Burn Pit

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	.20	.60	PCI/G	6
NP-237	.10	.70	PCI/G	6
PU-238	.10	.50	PCI/G	6
PU-239/240	.10	.40	PCI/G	6
RA-226	2.00	3.90	PCI/G	6
RU-106	2.00	2.00	PCI/G	6
SR-90	.50	.90	PCI/G	6
TC-99	.40	64.00	PCI/G	6
TH-228	.10	9.60	PCI/G	6
TH-230	.10	26.00	PCI/G	6
TH-232	.10	7.70	PCI/G	6
U-234	9.90	415.00	PCI/G	6
U-235	.50	27.00	PCI/G	6
U-238	22.00	454.00	PCI/G	6

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Clear Well

Inorganic

Compound	Minimun Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
ALUMINUM, TOTAL	12939.30	23770.50	MG/KG	4
ARSENIC, TOTAL	8.41	18.46	MG/KG	4
BARIUM, EP LEACHATE	1222.00	2613.00	UG/L	3
BARIUM, TOTAL	733.35	6913.40	MG/KG	4
BERYLLIUM, TOTAL	9.10	9.10	MG/KG	1
CADMIUM, TOTAL	5.11	7.15	MG/KG	2
CALCIUM, TOTAL	129304.89	183078.02	MG/KG	4
CHROMIUM, TOTAL	41.17	76.05	MG/KG	4
COBALT, TOTAL	18.34	18.34	MG/KG	1
COPPER, TOTAL	194.61	1119.30	MG/KG	4
CYANIDE, TOTAL	9.18	9.18	MG/KG	1
IRON, TOTAL	19618.07	21066.50	MG/KG	4
LEAD, TOTAL	32.26	83.00	MG/KG	4
MAGNESIUM, TOTAL	16784.64	44629.00	MG/KG	4
MANGANESE, TOTAL	761.15	1660.41	MG/KG	4
MERCURY, EP LEACHATE	.32	1.25	UG/L	4
MERCURY, TOTAL	.42	4.38	MG/KG	4
NICKEL, TOTAL	46.62	66.95	MG/KG	2
POTASSIUM, TOTAL	1690.00	3653.28	MG/KG	4
SELENIUM, TOTAL	3.72	3.72	MG/KG	1
SILVER, TOTAL	3.30	3.30	MG/KG	1
SODIUM, TOTAL	1293.44	3501.06	MG/KG	4
VANADIUM, TOTAL	99.70	2596.10	MG/KG	4
ZINC, TOTAL	81.81	194.35	MG/KG	4

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Clear Well

Organic

Compound	Minimun Concentration	Maximum Concentration	Unit Of Measure	No. Of Measurements
AROCLOR-1248	308.00	308.00	UG/KG	1
AROCLOR-1254	737.00	737.00	UG/KG	1

Clear Well

Radiochemistry

Compound	Minimum Activity Concentration	Maximum Activity Concentration	Unit Of Measure	No. Of Measurements
CS-137	18.00	450.00	PCI/G	4
NP-237	.40	2.70	PCI/G	4
PU-238	.10	.10	PCI/G	4
PU-239/240	.10	.10	PCI/G	4
RA-226	21.60	458.00	PCI/G	4
RU-106	3.00	24.00	PCI/G	4
SR-90	1.30	26.00	PCI/G	4
TC-99	.40	278.00	PCI/G	4
TH-228	.20	41.00	PCI/G	4
TH-230	.30	5600.00	PCI/G	4
TH-232	.10	39.00	PCI/G	4
U-234	242.00	376.00	PCI/G	4
U-235	24.00	49.00	PCI/G	4
U-238	548.00	670.00	PCI/G	4

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APPENDIX B

RESPONSE TO U.S. EPA COMMENTS ON ROUNDS 4 AND 5 GROUND WATER MONITORING REPORTS AND THE GROUND WATER QUALITY ASSESSMENT

Department of Energy
FMPC Site Office
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6319

RECEIVED
MAR 2 2 1989
U.S. EPA, REGION V
WASTE MANAGEMENT DIVISION
OFFICE OF THE DIRECTOR

March 23, 1989
DOE-828-89

Mr. Basil G. Constantelos
Director, Waste Management Division
U.S. Environmental Protection Agency
Region 5ME-14
230 South Dearborn St.
Chicago, IL 60604

Dear Mr. Constantelos:

GROUNDWATER MONITORING AT U.S. DOE FMPC-FERNALD, OHIO

Reference: Letter, W. E. Muno to J. A. Reafsnyder and M. B. Boswell, "Groundwater Monitoring - U.S. DOE FMPC - Fernald OH6 890 008 976," February 3, 1989

This letter provides by attachments: 1) response to U.S. EPA review comments on the FMPC RCRA Groundwater Quality Assessment Program Plan (GQAPP) for Waste Pit No. 4, and RCRA Sampling Rounds 4, 5 and 6 reports, and 2) a revised FMPC RCRA Groundwater Quality Assessment Program Plan. EPA's comments on these documents, detailed in the referenced letter, were received by DOE on February 7, 1989. DOE submitted the original GQAPP to EPA on November 25, 1987.

This revised Assessment Plan also satisfies the requirements of Section 3.7 of the Consent Decree, State of Ohio v. U.S. Department of Energy, et al.

If you have any questions, or require additional information, please contact Mary Stone, of my staff, at 513-738-6655.

Sincerely,

James A. Reafsnyder
James A. Reafsnyder
Site Manager

DP-84:Craig

Attachment: As stated

cc w/o att:

G. Bodenstein, DOE/ORO
C. McCord, U.S. EPA
R. Bendula, OEPA
L. Bogar, WMCO
C. Conner, WMCO

cc w/att:

G. Mitchell, OEPA
L. Sparks, DOE/ORO
M. Galper, WMCO

ATTACHMENT I

Response to EPA comments on Rounds 4 and 5
Groundwater Monitoring Reports,
and the Groundwater Quality Assessment Plan.

4th Quarter Sampling

(1) **Comment:**

The Results and Conclusions section of the May 1987 RCRA Groundwater Monitoring Report - Round 4 concluded that the distribution of radiological and non-radiological constituents appear to be localized around waste pit #4. No confirmatory sampling was performed, as required by 40 CFR 265.93(c)(2).

Response:

No deficiency exists since EPA regulations were followed correctly. Round 4 sampling was done in November 1986 to complete the detection monoitoring requirements of 40 CFR 265.92(c)(1). Detection monitoring established background concentrations through one year of quarterly sampling. A statistical difference was noticed in some of the indicator parameters following Round 5 sampling which was done to fullfil the semi-annual sampling requirements of 40 CFR 265.92(d). The confirmatory sampling requirements of 40 CFR 265.93 (c)(2) were fullfiled by Round 6 sampling (report issued to EPA March 1987).

is not in compliance [illegible] 265.93 (c)(2) [illegible] confirmatory [illegible] not made [illegible]

Resolution:

No further action required.

(2) **Comment:**

Page 3 - The report states that a well rehabilitation program is planned that will include disinfection. It is not appropriate that any substance be introduced into any monitoring wells.

Response:

~~The well~~ rehabilitation program was completed in the Spring 1988. Fifteen wells were repaired. No substances including disinfectants were introduced into the wells during this rehabilitation program.

[illegible]

Resolution:

No further action required.

(3) Comment:

Table 3.4 - The standards are out of date. There are primary drinking water standards for several volatile organic compounds (VOC) that are not listed. The fluoride standard is out of date; the current primary standard maximum concentration level (MCL) is 4 mg/l and secondary standard is 2 mg/l.

Response:

The standards referenced for fluoride in table 3.4 was out of date and the drinking water standards for some VOC were not listed. However, this did not affect the quality or accuracy of the data presented.

Resolution:

The correct standards will be referenced as appropriate in all future submittals.

(4) Comment:

Table 2 - Samples collected for VOC analysis should be collected in 40 ml septum vials, not 1000 ml glass containers.

Response:

The specification of 1000 ml glass containers for collecting VOC samples for analysis was incorrectly stated in table 2. Samples for VOC analysis were collected in 40 ml septum vials.

Resolution:

No further action required.

(5) Comment:

All samples collected for pesticide analysis were held past the holding times. Some samples were held for just under two months. The holding time for the sample collected from well MW-21(S) exceeded the VOC holding time limit of fourteen (14) days. The sample was held for twenty-nine (29) days.

Response:

Efforts are being made to observe proper holding times. Pesticide and VOC sampling was repeated March-April 1988 for Round 1 of assessment monitoring during which the proper holding times were observed.

Resolution:

Efforts will be continued to ensure that proper holding times for all samples are observed.

5th Quarter Sampling

(1) Comment:

All "TP" wells were installed with a backhoe. The newly developed well decommissioning criteria should be applied to these "TP" wells for evaluation of well decommissioning.

Response:

Well decommissioning criteria do apply to the test pit (TP) wells. Once an evaluation for well decommissioning has been made the test pit wells will either remain in service or be decommissioned appropriately.

Resolution:

No further action required.

(2) Comment:

The observation of surface water flowing under the surface seal of well MW-10 and the fact that not all older wells have protective covers needs to be addressed.

Response:

A well renovation program was completed in Spring 1988. Repairs were done to fifteen wells including MW-10 and the older wells mentioned above. Well MW-10 was repaired to prevent surface water from flowing under its surface seal. Also, protective covers were installed on all older wells that needed them.

Resolution:

No further action required.

(3) Comment:

Page 7 - Low yielding wells should be pumped dry unless a minimum of three to five well volumes are removed from the well.

Response:

The well development procedure for low yielding wells is to pump the well dry unless a minimum of three to five well volumes can be removed. Current well development procedures are in Revision 1 of the Groundwater Quality Assessment Program Plan (GQAPP) and Revision 3 of the RI/FS Work Plan.

Resolution:

No further action required.

(4) Comment:

Page 13 - TOC samples must have a preservative to adjust pH below 2. TOX samples must have 1 ml of 1.1 M sodium sulfite added for preservation.

Response:

Preservative is applied to TOC samples to adjust the pH below 2. Also, 1 ml of 1.1 M sodium sulfite is added as preservative to TOX samples. Current sampling procedures can be referenced in the GQAPP Rev. 1 and the RI/FS Quality Assurance Project Plan Revision 3.

Resolution:

No further action required.

(5) Comment:

Page 14 - What are the sampling procedures for dissolved metals?

Response:

For dissolved metals the samples are filtered immediately following collection on site. Preservatives are then added. Further details on the sampling procedures can be referenced in Revision 3 of the RI/FS Quality Assurance Project Plan.

Resolution:

No further action required.

(6) Comment:

Page 14, Paragraph 5 - The use of acetone was not mentioned.

Response:

Acetone was used to clean equipment during Round 5 detection monitoring. This practice was discontinued after it was discovered that the acetone was contaminating the samples. Current procedures for cleaning equipment during sampling can be referenced in Revision 1 of the Groundwater Quality Assessment Program Plan (GQAPP) and Revision 3 of the RI/FS Work Plan.

Resolution:

No further action required.

(7) **Comment:**

Page 15, Item 3: The report does not detail how equipment cleaning and laboratory analytical procedures will be modified in future rounds to prevent false results.

Response:

+ consistent - and adequate revision [illegible]

Sampling procedures were revised to discontinue the use of acetone for cleaning equipment between samples. Equipment is now cleaned using deionized water rinses. Current sampling procedures can be referenced in Revision 1 of the GQAPP and Revision 3 of the RI/FS Quality Assurance Project Plan.

Resolution:

No further action required.

(8) **Comment:**

Page 16, Table 2 - VOC samples should be collected in 40 ml septum vials, not 1000 ml glass containers.

Response:

The specification of 1000 ml glass containers in Table 2 for collecting VOC samples was an error. Samples for VOC were collected in 40 ml septum vials.

Resolution:

No further action required.

(9) **Comment:**

Page 18 - 40 CFR 265.92(c)(2), not 40 CFR 265.90, requires four replicates.

Response:

The correct reference intended to be made on page 18 is 40 CFR 265.92(c)(2) which specifies four replicate samples for indicator parameters.

Resolution:

Accurate references will be made in future submittals.

(10) **Comment:**

Table 3.5 - Some of the standards are out of date. MCL's for VOC's are not given. The standard for fluoride is incorrect.

Response:

Some of the standards for hazardous constituents referenced in Table 3.5 in the Round 5 RCRA detection monitoring report were out of date. However, this error did not compromise the analytical data presented.

Resolution:

Correct standards will be referenced in future submittals.

(11) Comment:

In what order will samples for certain parameters be collected? It is desirable to establish an order.

Response:

Samples are collected in accordance with the stability and volatility of the parameters to be tested. For example, samples for HSL volatile organic compounds, pH, specific conductance, and temperature are collected first. Parameters which not are sensitive to pH or volatilization are drawn last.

Resolution:

No action required.

(12) Comment:

Neither the actual data used to calculate the statistics, nor the calculations, have been included.

Response:

Appropriate data and statistical methods were used for all calculations as prescribed by 40 CFR 265.92 & 265.93. The RCRA Groundwater Monitoring Report - Round 5, Vol. 5, Nov. 1987 provided the data and statistical calculation. A copy of this report was transmitted to EPA 11/13/87.

Resolution:

No further action required.

(13) Comment:

Pesticide samples were held past the seven day holding time limit for many samples.

Response:

Efforts are being made to observe the correct holding times on all samples. This is evidenced by pesticide samples which were taken March-April 1988 during Round 1 assessment monitoring with correct holding times being observed.

Resolution:

Efforts will continue to be made to observe the holding times as prescribed by the sampling procedures.

Groundwater Quality Assessment Program Plan

(1) **Comment:**

The sampling frequency for Assessment monitoring is quarterly, not semi-annually for site-specific parameters, as required by 40 CFR 265.93(d)(7)(i) and Ohio Administrative Code (OAC) 3745-65-93(D)(7)(i).

Response:

A semi-annual sampling frequency for site specific parameters, during assessment monitoring, was incorrectly stated. However, assessment monitoring, which started March 1988, has been done quarterly.

Resolution:

Quarterly sampling for site specific parameters has been specified in Revision 1 of the Groundwater Quality Assessment Program Plan (GQAPP).

(2) **Comment:**

The Assessment Plan does not describe the detection monitoring system used to make the statistical comparisons.

Response:

A groundwater detection monitoring system as specified by 40 CFR 265.91 was used to obtain data for the statistical comparisons done. This information was supplied to the EPA in Rounds 1-5 detection monitoring reports.

Resolution:

The detection monitoring system used to make statistical comparisons is described in Sections 3.1 through 3.3 of Revision 1 of the GQAPP.

(3) **Comment:**

The Assessment Plan and the Sampling Plan do not present adequate information concerning the location, depth of screened intervals, or length of screen intervals.

Response:

Information concerning the location, depth of screen intervals, and length of screen was presented in the GQAPP.

Resolution:

The location, depth of screened intervals and the length of screen intervals is described in Section 4.2 and Table 4 of the revised GQAPP.

(4) Comment:

The Assessment Plan and the Groundwater Monitoring Reports need to establish the direction of groundwater flow in each of the monitored aquifers. The Assessment Plan indicates that the localized direction of groundwater flow is towards the east. A review of the water levels and use of three-point problems indicates that the groundwater flow in the shallow aquifer is towards the northeast.

Response:

Statements about groundwater flow made in the Groundwater Quality Assessment Program Plan were based on data available at that time.

Resolution:

Revision 1 of the GQAPP provides details on current information on a groundwater flow.

(5) Comment:

Using either flow direction, east or northeast, indicates that the landfill (waste pit #4) is not monitored by the required three downgradient wells, as required by 40 CFR 265.91(a)(2) and OAC 3745-65-91(A)(2).

Response:

The downgradient wells utilized as part of the RCRA detection monitoring at waste pit #4 were installed based on knowledge available at that time. These wells supplied enough data to indicate that a RCRA assessment monitoring program was needed. Additional wells were installed in the waste storage area to improve the knowledge of the groundwater flow.

Resolution:

Revision 1 of the GQAPP describes the updated monitoring network, incorporating newly installed RI/FS wells, being used to fulfill the requirements for RCRA assessment monitoring.

(6) Comment:

Section 3.1, Page 11 - A.0.01 level of significance should have been used instead of 0.05 level.

Response:

The 0.05 level of significance used for the Student's T-test did not affect the determination of a statistical difference in indicator parameters which caused the initiation of a RCRA assessment monitoring program.

Resolution:

The appropriate statistical procedures will be utilized in any future statistical determinations.

? TOX?

(7) **Comments:**

Section 3.1, Page 11 - The variance for TAWS values is extremely large. This is due to a two-order of magnitude increase of TAWS in background wells during the third sampling round. Elevated values of this magnitude for TAWS were not observed after round three, suggesting that the third round data may be anomalous.

Response:

The very large TOX variances was due to a two-order of magnitude increase of TOX concentrations recorded during third round detection monitoring sampling.

Resolution:

Strict sampling and analytical quality control procedures are being employed to limit errors in the data being compiled. Sampling and analytical methods can be reviewed in Revision 1 of the GQAPP.

(8) **Comment:**

Section 3.2, Page 16 - The continued collection of additional RCRA groundwater monitoring samples and the list of sample parameters is appropriate. However, sampling and analytical methods are not listed, as required by 40 CFR 265.93(d)(3)(ii) and OAC 3745-65-93(D)(3)(ii).

Response:

The GQAPP state that the additional RCRA monitoring was to be conducted as part of the RI/FS program. The sampling and analytical procedures are contained in the RI/FS Work Plan Revision 3.

Resolution:

Revision 1 of the GQAPP provides sampling and analytical methods in Sections 4.4 and 4.5.

(9) **Comment:**

Section 3.2, Page 17 - The Assessment Plan does not provide a reason for the additional upgradient wells. No information is presented concerning the establishment of background mean and variance values for the indicator parameters. Information on new background well or wells should be provided.

Response:

The Groundwater Quality Assessment Plan stated that the additional upgradient wells were being installed "as specifically requested by Ohio and U.S. EPA." Also, information was presented in Section 3.1 on the establishment of background mean and variance values for indicator parameters. Revised information on the rationale for well placement and the establishment of background mean and variance values for indicator parameters are being discussed in detail in Sections 3 and 4.2 of the GQAPP Revision 1.

Resolution:

None necessary.

(10) **Comment:**

Section 3.3, Page 17, - Results of the Characterization Investigation Study (CIS) should be used in selecting appropriate analytes for the assessment program.

Response:

Results of the Characterization Investigation Study were used to select the appropriate analytes for assessment. This issue is discussed in detail in Section 3.4.2 of Revision 1 of the GQAPP.

Resolution:

None necessary.

(11) **Comment:**

Section 3.4, Page 17 - The wells discussed in this section may be appropriate for monitoring pit #4.

Response:

Wells to be used for monitoring in the vicinity of waste pit #4 are discussed in Section 4.2 and listed in table 3 Revision 1 of the GQAPP.

Resolution:

None necessary.

(12) **Comment:**

Section 4.0, Page 24-41 - This general discussion of Remedial Investigation (RI) activities does not address the specific situation at waste pit #4.

Response:

The specific situation at waste pit #4 was not the entire focus of Section 4 even though the discussion on the RI/FS was relevant.

Resolution:

Section 4.0 of the GQAPP has been revised to focus specifically on the waste pit #4.

(13) **Comment:**

Section 4.2 - There are several errors in this section, including screened intervals and zones that are to be monitored.

Response:

Section 4.2 of the GQAPP contained a discussion of the screened intervals of the wells and the zones to be monitored. The errors referred to need to be specifically identified. Section 4.2 of the GQAPP Revision 1 has been rewritten and discusses screen intervals of wells and the zones to be monitored.

Resolution:

None necessary.

(14) **Comment:**

Section 4.3 - The Installation Methods and Materials section needs to be rewritten to correct numerous errors with respect to screened intervals and zones to be monitored.

Response:

Section 4.2 of the GQAPP contained a discussion of the screened intervals of the wells and the zones to be monitored. The numerous errors with respect to screen intervals and zones to be monitored need to be specifically identified. Section 4.2 of the GQAPP Revision 1 has been rewritten and discusses screened intervals of wells and the zones to be monitored.

Resolution:

None necessary.

(15) **Comment:**

Section 4.6, Page 37 - The Assessment Plan must include sampling and analytical methods for relevant hazardous wastes and hazardous waste constituents, as required by 40 CFR 265.93(d)(3)(ii). References to the RI groundwater monitoring in the Assessment Plan is not adequate, even though the RCRA and RI groundwater monitoring systems have been merged.

Response:

Sampling and analysis was discussed in the GQAPP even though specific sampling and analytical methods were not discussed.

Resolution:

Sampling and analytical methods are discussed in Section 4.4 and 4.5 with details included as appendices in Revision 1 GQAPP.

(16) **Comment:**

The facility must determine the rate, extent of migration, and concentrations of hazardous waste or hazardous waste constituents, as required by 40 CFR 265.93(d)(4) and OAC 3745-65-93(D)(4).

Response:

This is the objective of Groundwater Qualilty Assessment Program Plan Revision 1 of the GQAPP provides details of the current program.

Resolution:

No action required.

(17) **Comment:**

Confirmatory sampling required by 40 CFR 265.93(c)(2) is not presented in the Assessment Plan.

Response:

Confirmatory sampling was performed in December 1987 during Round 6 of the groundwater monitoring program. A report was issued March 1988.

Resolution:

Section 3.3 of the GQAPP Revision 1 discusses confirmatory sampling.

(18) **Comments:**

Please clarify what existing and newly installed Remedial Investigation (RI) wells are considered a part of the RCRA ground water monitoring system and are used in the assessment.

Response:

The wells to be used for RCRA groundwater monitoring and RI/FS were discussed in the GQAPP.

Resolution:

Sections 3 and 4 of Revision 1 GQAPP provide specific details on which wells are part of the RCRA groundwater monitoring system.

(19) **Comments:**

Water samples should be taken from Paddy's Run to check local groundwater flow discharging to the creek from the facility.

Response:

Sampling of the water and sediments in Paddy's Run is within the scope of the RI/FS as defined in Revision 3 of the RI/FS Work Plan.

Resolution:

Sediment and surface water is being sampled as part of the RI/FS surface water and sediment sampling program.

(20) **Comment:**

Page 20 - If contamination is found, site-specific parameters are required by 40 CFR 265.93(d)(3)(ii) and must be monitored quarterly until final closure, as required by 40 CFR 265.93(d)(7)(i) and OAC 3745-65-93(D)(7)(i).

Response:

RCRA assessment monitoring wells are being sampled quarterly for site specific parameters. Section 3.4.2 of the GQAPP Revision 1 provides details on the assessment monitoring program.

Resolution:

None required.

(21) Comment:

Page 33 - Should contamination be found above the blue clay layer, additional wells should be installed immediately below the clay and at the bottom of the sand and gravel aquifer. Positioning the bottom of the screen 10 feet above the bedrock will not allow for detection of dense constituents.

Response:

Investigations conducted up to this point have not indicated any hazardous waste constituents below the blue clay layer. Should any hazardous waste constituents be discovered at some future date during the course of RI/FS and RCRA assessment activities, an evaluation will be made and an appropriate course of action pursued.

Resolution:

No further action required.

(22) Comment:

Page 33 - Whether or not the clay unit is an aquitard has not been clarified. Tests may be proposed for verifying this statement.

Response:

The RCRA assessment and RI/FS programs are currently investigating the rate and extent of migration of site specific parameters. Groundwater modeling is being conducted as part of the RI/FS to investigate water movement through the blue clay. This modeling is anticipated to be completed by third quarter 1990.

Resolution:

No further action required.

(23) Comment:

Page 33 - A 15-foot well screen is too long. The screen should span the water bearing zone with a maximum length of 10 feet. The sand pack should not exceed 15 feet.

Response:

A fifteen foot screen on 2000 series wells was discussed in Section 4 of the RI/FS Work Plan Revision 3 which was approved by the EPA in May 1988.

Resolution:

No further action required.

(24) Comment:

Page 35 - A minimum of three to five well volumes should be extracted during well development.

Response:

Although not clearly stated on page 35, a minimum of three to five well volumes are extracted from the groundwater monitoring wells during well development. Well sampling procedures are discussed in detail in Revision 1 of the GQAPP.

Resolution:

No further action required.

(25) Comment:

Page 36 - Identify which wells will be used for pump/slug tests.

Response:

Wells to be used for pump/slug tests were identified on pages 35 and 36 of the GQAPP.

Resolution:

Section 4.6 of the revised GQAPP discusses well usage for slug tests.

(26) Comment:

Page 37 - Which of the wells designated to monitor Pit #4 are to be sampled for the organics and metals in item 1? What constituents will each well be sampled for? All existing and proposed wells that monitor Pit #4 should be analyzed for RCRA hazardous waste constituents, as indicated by the RI work plan.

Response:

A discussion was presented on the RCRA constituents to be sampled and the frequency of this sampling.

Resolution:

The wells designated to monitor the groundwater quality in the vicinity of Pit #4 and the RCRA hazardous constituents for which they will be sampled and analyzed are outlined in Sections 3 and 4 of Revision 1 of the GQAPP.

(28) **Comment:**

Provide sampling and analytical methods, as required by 40 CFR 265.93(d)(3)(ii) and OAC 3745-65-93(D)(3)(ii).

Response:

Sampling and analysis for RCRA assessment monitoring was discussed in the GQAPP even though specific sampling and analytical methods were not discussed.

Resolution:

Sampling and analytical methods are discussed in Sections 4.4 and 4.5 of Revision 1 of the GQAPP.

APPENDIX C

COMPLIANCE CHECKLISTS

APPENDIX A

Comprehensive Ground-Water Monitoring Evaluation Worksheet

This check list is completed for the conditions which exist at the site at the time of the inspection. There is no single (or even several) location of all the Hydrogeologic information needed to assess the RCRA monitoring Program. FMPC is using an integrated approach of sharing RI/FS data, Facilities Testing Plan data, and RCRA assessment monitoring data. All available information was used to complete this check list (not only information presented in the RCRA Monitoring/Assessment Programs).

APPENDIX A

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION WORKSHEET

The following worksheets have been designed to assist the enforcement officer/ technical reviewer in evaluating theground-water monitoring system an owner/operator uses to collect and analyze samples of ground water. The focus of the worksheets is technical adequacy as it relates to obtaining and analyzing representative samples of ground water. The basis of the worksheets is the final RCRA Ground Water Monitoring Technical Enforcement Guidance Document which describes in detail the aspects of ground-water monitoring which EPA deems essential to meet the goals of RCRA. Appendix A is not a regulatory checklist. Specific technical deficiencies in the monitoring system can, however, be related to the regulations as illustrated in Figure 4.3 taken from the RCRA Ground-Water Monitoring Compliance Order Guide (COG) (included at the end of the appendix). The enforcement officer, in developing an enforcement order, should relate the technical assessment from the worksheets to the regulations using Figure 4.3 from the COG as a guide.

Comprehensive Ground-Water Monitoring Evaluation	Y/N
I. Office Evaluation Technical Evaluation of the Design of the Ground-Water Monitoring System A. Review of Relevant Documents 1. What documents were obtained prior to conducting the inspection: a. RCRA Part A permit application?	Y
b. RCRA Part B permit application?	N
c. Correspondence between the owner/operator and appropriate agencies or citizen's groups?	Y
d. Previously conducted facility inspection reports?	Y
e. Facility's contractor reports?	[illegible]
f. Regional hydrogeologic, geologic, or soil reports?	Y
g. The facility's Sampling and Analysis Plan?	Y
h. Ground-water Assessment Program Outline (or Plan, if thefacility is in assessment monitoring)?	Y
i. Other (specify) RI/FS Work Plan & QAPP / Characterization investigation study / USGS Reports / Groundwater sampling Reports rounds 3 through [illegible], RI/FS database	94

	Y/N
B. Evaluation of the Owner/Operator's Hydrogeologic Assessment	
1. Did the owner/operator use the following direct techniques in the hydrogeologic assessment:	
a. Logs of the soil borings/rock corings (documented by a professional geologist, soil scientist, or geotechnical engineer)?	Y
b. Materials tests (e.g., grain size analyses, standard penetration tests, etc.)?	Y
c. Piezometer installation for water level measurments at different depths?d. Slug tests?	Y
e. Pump tests?	N
f. Geochemical analyses of soil samples?	Y
g. Other (specify) (e.g., hydrochemical diagrams and wash analysis)	Y
Regional Hydrogeology well documented by over 20 years of Geologic investigation in the area by DOE & USGS.	
2. Did the owner/operator use the following indirect technique to supplement direct techniques data:	
a. Geophysical well logs?	N
b. Tracer studies?	N
c. Resistivity and/or electromagnetic conductance?	Y
d. Seismic Survey?	N
e. Hydraulic conductivity measurements of cores? Shelby tubes collected of low permeability units but not analyzed yet.	N
f. Aerial photography?	
g. Ground penetrating radar?	
h. Other (specify) [illegible] (Fidler walk over)	Y
3. Did the owner/operator document and present the raw data from the site hydrogeologic assessment? Brief discussions on till & sand and gravel units ~~[illegible]~~ indepth analysis of these units is ongoing	Y
4. Did the owner/operator document methods (criteria) used to correlate and analyze the information?	Y
5. The owner/operator prepare the following:	
a. Narrative description of geology?	
b. Geologic cross sections? generalized (specific ones are forthcoming)	
c. Geologic and soil maps?	N
d. Boring/coring logs? these were constructed but many not made available for inspector review.	Y
e. Structure contour maps of the differing water bearing zones and confining layer?	N/A
f. Narrative description and calculation of ground-water flows?	Brief

	Y/N
g. Water table/potentiometric map?	Y
h. Hydrologic cross sections?	Y
6. Did the owner/operator obtain a regional map of the area and delineate the facility?	
If yes, does this map illustrate: a. Surficial geology features?	Y
b. Streams, rivers, lakes, or wetlands near the facility?	Y
c. Discharging or recharging wells near the facility?	Y
7. Did the owner/operator obtain a regional hydrogeologic map?	
If yes, does this hydrogeologic map indicate: a. Major areas of recharge/discharge?	Y
b. Regional ground-water flow direction?	Y
c. Potentiometric contours which are consistent with observed water level elevations? [illegible] general agreement in v. complex till.	Y
8. Did the owner/operator prepare a facility site map?	
If yes, does the site map show: a. Regulated units of the facility (e.g., landfill areas,impoundments)?	Y
yes b. Any seeps, springs, streams, ponds, or wetlands? map should show seeps	Y
c. Loc...on of monitoring wells, soil borings, or test pits?	Y
d. How many regulated units does the facility have? [illegible]	
If more than one regulated unit then, [illegible]	
• Does the waste management area encompass all regulated units?	Y
• Is a waste management area delineated for each regulated unit?	Y
C. Characterization of Subsurface Geology of Site	
1. Soil boring/test pit program:	
a. Were the soil borings/test pits performed under thesupervision of a qualified professional?	Y
b. Did the owner/operator provide documentation for selecting the spacing for borings? Not in any written report. Telephone conversation on 7/24/89 (rationale somewhat suspect).	Y
c. Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock?	Y
d. Indicate the method(s) of drilling:	96

	Y/N
Auger (hollow or solid stem) ____ Mud rotary ____ Reverse rotary ____ Cable tool ____ Jetting ____ Other (specify) ________	
e. Were continuous sample corings taken? yes to bottom of till [illegible]	
f. How were the samples obtained (checked method[s]) [illegible] • Split spoon Y • Shelby tube, or similar ____ • Rock coring ____ • Ditch sampling ____ • Other (explain) ________	
g. Were the continuous sample corings logged by a qualified professional in geology?	Y
h. Does the field boring log include the following information: • Hole name/number?	Y
• Date started and finished?	Y
• Driller's name?	Y
• Hole location (i.e., map and elevation)?	Y
• Drill rig type and bit/auger size?	Y
• Gross petrography (e.g., rock type) of each geologic unit?	Y
• Gross mineralogy of each geologic unit?	Y
• Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material)?	Y
• Development of soil zones and vertical extent and description of soil type?	[illegible]
• Depth of water bearing unit(s) and vertical extent of each?	Y
• Depth and reason for termination of borehole?	Y
• Depth and location of any contaminant encountered in borehole?	Y
• Sample location/number?	Y
• Percent sample recovery?	Y
• Narrative descriptions of: —Geologic observations?	Y
—Drilling observations?	Y
i. Were the following analytical tests performedon the core samples: • Mineralogy (e.g., microscopic tests and x-ray diffraction)?	N
• Petrographic analysis: —degree of crystallinity and cementation of matrix?	N
—degree of sorting, size fraction (i.e., sieving), textural variations?	N
—rock type(s)?	N 97

	Y/N
—soil type?	Y
—approximate bulk geochemistry?	N
—existence of microstructures that may effect or indicate fluid flow?	N
• Falling head tests? slug test on some till wells only	Y
• Static head tests?	–
• Settling measurements?	–
• Centrifuge tests?	–
• Column drawings?	–
D. Verification of Subsurface Geological Data	
1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations?	N
2. Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically low water-bearing units? Blue clay not ~~as~~ extensive as thought. no shelby tubes analyzed for vert. perm. to date.	N
3. Is the confining layer laterally continuous across the entire site? Blue clay ends at ~~[illegible]~~ western edge of production area.	N
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer?	N/A
5. Did the geologic assessment address or provide means for resolution of any information gaps of geologic data?	N
6. Do the laboratory data corroborate the field data for petrography?	N/A
7. Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry?	N/A
E. Presentation of Geologic Data	
1. Did the owner/operator present geologic cross sections of the site? very generalized	Y
2. Do cross sections:	
a. identify the types and characteristics of the geologic materials present?	Y
b. define the contact zones between different geologic materials?	Y
c. note the zones of high permeability or fracture?	Y
d. give detailed borehole information including:	Y

	Y/N
• location of borehole?	Y
• depth of termination?	Y
• location of screen (if applicable)?	Y
• depth of zone(s) of saturation?	Y
• backfill procedure?	Y
3. Did the owner/operator provide a topographic map which was constructed by a licensed surveyor? USGS QUADRANGLE MAP map not of sufficient detail	N
4. Does the topographic map provide: a. contours at a maximum interval of two-feet?	N
b. locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drain, pipelines, etc.)?	Y
c. descriptions of nearby water bodies?	Y
d. descriptions of off-site wells?	Y
e. site boundaries?	Y
f. individual RCRA units?	Y
g. delineation of the waste management area(s)?	N
h. well and boring locations?	Y
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features?	Y
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labelled?	Y
F. Identification of Ground-Water Flowpaths 1. Ground-water flow direction a. Was the well casing height measured by a licensed surveyor to the nearest 0.01 feet?	Y
b. Were the well water level measurements taken within a 24 hour period?	N [illegible] 2 days
c. Were the well water level measurements taken to the nearest 0.01 feet?	[illegible] 0.05
d. Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements?	Y
e. Was the water level information obtained from (check appropriate one): • multiple piezometers placed in single borehole? ____ • vertically nested piezometers in closely spaced separate _X_ • boreholes? ____ • monitoring wells? _X_	99

	Y/N
f. Did the owner/operator provide construction details for the piezometers?	Y
g. How were the static water levels measured (check method[s]). • Electric water sounder X • Wetted tape ____ • Air line ____ • Other (explain) ____	
h. Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone?	/
i. Has the owner/operator provided a site water table (potentiometric) contour map?	Y
If yes, • Do the potentiometric contours appear logical and accurate based on topography and presented data? (Consult water level data)	Y
• Are ground-water flow-lines indicated?	N
• Are static water levels shown?	Y
• Can hydraulic gradients be estimated? no K or θ information	N
j. Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells? [illegible]	/
k. Do the owner/operator's flow nets include: • piezometer locations?	N/A
• depth of screening?	
• width of screening?	
• measurements of water levels from all wells and piezometers?	
2. Seasonal and temporal fluctuations in ground-water	
a. Do fluctuations in static water levels occur? If yes, are the fluctuations caused by any of the following:	Y
—Off-site well pumping	Y indeterm.?
—Tidal processes or other intermittent natural variations (e.g., river stage, etc.)	✓
—On-site well pumping	✓
—Off-site, on-site construction or changing land use patterns	✓
—Deep well injection	✓
—Seasonal variations	Y
—Other (specify) ____	
b. Has the owner/operator documented sources and patterns that contribute to or affect the ground-water patterns below the waste management? [illegible] ground water mound.	N
c. Do water level fluctuations alter the general ground-water gradients and flow directions?	
d. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone? yes but not significant [redacted]	100

[redacted]

	Y/N
e. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns? SP ground water model.	Y
3. Hydraulic conductivity a. How were hydraulic conductivities of the subsurface materials determined?	
• Single-well tests (slug tests)? slug test in till wells 1079 [illegible]	Y
• Multiple-well tests (pump tests) [illegible]	
• Other (specify) ______	
b. If single-well tests were conducted, was it done by: • Adding or removing a known volume of water?	X
• Pressurizing well casing?	
c. If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels?	tests performed in low K till unit
d. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit? the till is very inhomogenous and only 2 wells were tested in the waste pit area.	N
e. Is the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)?	Y
f. Were other hydraulic conductivity properties determined?	
g. If yes, provide any of the following data, if available: • Transmissivity [illegible] – 300,000 gpd • Storage coefficient [illegible] • Leakage ______ • Permeability ______ [illegible] reports [illegible] aquifer • Porosity ______ • Specific capacity ______ • Other (specify) [illegible] present [illegible] of till [illegible]	
4. Identification of the uppermost aquifer a. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes,	✓
• Are soil boring/test pit logs included?	X
• Are geologic cross-sections included?	✓
b. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? If yes,	Y
• how was continuity demonstrated? [illegible] studies	
c. What is hydraulic conductivity of the confining unit (if present)? CM/Sec How was it determined? Not given -- stated in Regional Reports as impermeable shale bedrock.	101

	Y/N
d. Does potential for other hydraulic communication exist (e.g., lateral inconntnuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachage? If yes or no, what is the rationale? Yes Paddy's run is a losing stream which provides recharge (contaminated surface & storm water runoff) to the sand & gravel aquifer	Y
G. Office Evaluation of the Facility's Ground-Water Monitoring System—Monitoring Well Design and Construction: These questions should be answered for each different well design present at the facility. 1. Drilling Methods a. What drilling method was used for the well? • Hollow-stem auger ☐ • Solid-stem auger ☐ • Mud rotary ☐ • Air rotary ☐ • Reverse rotary ☐ • Cable tool ☒ • Jetting ☐ • Air drill w/ casing hammer ☐ • Other (specify) ______	
b. Were any cutting fluids (including water) or additives used during drilling? If yes, specify: • Type of drilling fluid ______ • Source of water used onsite deep production well. • Foam ______ • Polymers ______ • Other ______	
c. Was the cutting fluid, or additive, identified?	N
d. Was the drilling equipment steam-cleaned prior to drilling the well? • Other methods ______	N
e. Was compressed air used during drilling? If yes, • was the air filtered to remove oil?	N
f. Did the owner/operator document procedure for establishing the potentiometric surface? If yes, • how was the location established? electronic tape	Y
g. Formation samples	102

	Y/N
• Were formation samples collected initially during drilling?	X
• Were any cores taken continuous?	N
• If not, at what interval were samples taken? continuous through the fill & then at 5 foot centers	
• How were the samples obtained? ✓Split spoon XShelby tube —Core drill —Other (specify)	
• Identify if any physical and/or chemical tests were performed on the formation samples (specify) 1) ASTM standard penetration test 2) PID & organic vapor screening	
2. Monitoring Well Construction Materials	
a. Identify construction materials (by number) and diameters (ID/OD) Material / Diameter • Primary Casing: SS / 4" ID • Secondary or outside casing (doubleconstruction): ____ / ____ • Screen: SS / 4" ID	
b. How are the sections of casing and screen connected? • Pipe sections threaded — threaded flush jointed	
• Couplings (friction) with adhesive or solvent	
• Couplings (friction) with retainer screws	
• Other (specify)	
c. Were the materials steam-cleaned prior to installation? • If no, how were the materials cleaned? ____	✓
3. Well Intake Design and Well Development a. Was a well intake screen installed?	✓
• What is the length of the screen for the well? 10 ft in most cases 15 feet across W.T. in 2000 series wells	
• Is the screen manufactured?	✓
b. Was a filter pack installed?	
• What kind of filter pack was employed? coarse graded 2+ sand	
• Is the filter pack compatible with formationmaterials?	✓
• How was the filter pack installed? Direct placement in annulus (no tremie pipe)	103

	Y/N
• What are the dimensions of the filter pack? 10" ϕ & usually 2-4 feet above well screen in 1000-2000 series wells; 3-5' above in 3000-4000 wells.	
• Has a turbidity measurement of the well water ever been made?	X
• Have the filter pack and screen been designed for the insitu materials? yes -- two different grades of sand were used.	
c. Well development • Was the well developed?	X
• What technique was used for well development? X Surge block and —Bailer —Air surging X Water pumping —Other (specify) ______	
4. Annular Space Seals a. What is the annular space in the saturated zone directlyabove the filter pack filled with: X Sodium bentonite (specify type and grit) Volclay tablets —Cement (specify neat or concrete) —Other (specify)	
b. Was the seal installed by: —Dropping material down the hole and tamping —Dropping material down the inside of hollow-stem auger —Tremie pipe method X Other (specify) direct placement -- pouring tablets in annulus & measuring	
c. Was a different seal used in the unsaturated zone? If yes,	Y
• Was this seal made with? X Sodium bentonite (specify type and grit) Volclay grout —Cement (specify neat or concrete)- Other (specify)	
• Was this seal installed by? —Dropping material down the hole and tamping —Dropping material down the inside of hollow stem auger X Other (specify) pressure grouting with tremie pipe from bottom to top	
d. Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface?	Y
e. Is the well fitted with an above-ground protectivedevice and bumper guards?	Y
f. Has the protective cover been installed with locks to prevent tampering?	Y 104

	Y/N
H. Evaluation of the Facility's Detection Monitoring Program *Facility in assessment monitoring.* 1. Placement of Downgradient Detection Monitoring Wells a. Are the ground-water monitoring wells or clusters located immediately adjacent to the waste management area?	
b. How far apart are the detection monitoring wells?	
c. Does the owner/operator provide a rationale for thelocation of each monitoring well or cluster?	
d. Does the owner/operator identified the well screenlengths of each monitoring well or clusters?	
e. Does the owner/operator provide an explanation for the well screen lengths of each monitoring well orcluster?	
f. Do the actual locations of monitoring wells orclusters correspond to those identified by the owner/operator?	
2. Placement of Upgradient Monitoring Wells a. Has the owner/operator documented the location ofeach upgradient monitoring well or cluster?	
b. Does the owner/operator provide an explanation forthe location(s) of the upgradient monitoring wells?	
c. What length screen has the owner/operator employed inthe background monitoring well(s)?	
d. Does the owner/operator provide an explanation for the screen length(s) chosen?	
e. Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator?	
I. Office Evaluation of the Facility's Assessment Monitoring Program 1. Does the assessment plan specify: a. The number, location, and depth of wells?	Y
b. The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases?	N
2. Does the list of monitoring parameters include all hazardous waste constituents from the facility?	Y 105

	Y/N
a. Does the water quality parameter list include other important indicators not classified as hazardous waste constituents?	Y
b. Does the owner/operator provide documentation for the listed wastes which are not included?	N
3. Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the ground-water? ground water modeling of RFI's data.	Y vaguely
4. Has the owner/operator specified a schedule of implementation in the assessment plan? yes but it is not specific to waste pit 4	Y
5. Have the assessment monitoring objectives been clearly defined in the assessment plan?	
a. Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurredin any of the detection monitoring wells?	N
b. Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility?	N
c. Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituentsin the ground water?	N
d. Does the plan employ a quarterly monitoring program?	Y
6. Does the assessment plan identify the investigatory methods that will be used in the assessment phase?	
a. Is the role of each method in the evaluation fully described?	Y
b. Does the plan provide sufficient descriptions of the direct methods to be used?	Y
c. Does the plan provide sufficient descriptions of the indirect methods to be used?	Y
d. Will the method contribute to the further characterization of the contaminant movement?	N
7. Are the investigatory techniques utilized in the assessment program based on direct methods? Facility completed its 1st Assessment Monitoring network. Planned activity is to only monitor and not do any more investigative work.	Y
a. Does the assessment approach incorporate indirect methods to further support direct methods?	N
b. Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring?	N
c. Are the procedures well defined?	Y
d. Does the approach provide for monitoring wells similar in design and construction as the detectionmonitoring wells?	Y 106

	Y/N
e. Does the approach employ taking samples during drilling or collecting core samples for further analysis?	Y
8. Are the indirect methods to be used based on reliable and accepted geophysical techniques?	N/A
a. Are they capable of detecting subsurface changesresulting from contaminant migration at the site?	
b. Is the measurement at an appropriate level of sensitivity to detect ground-water quality changes at the site?	
c. Is the method appropriate considering the nature of the subsurface materials?	
d. Does the approach consider the limitations of these methods?	
e. Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods tofurther substantiate the findings.)	
9. Does the assessment approach incorporate any mathe-matical modeling to predict contaminant movement?	
a. Will site specific measurements be utilized toaccurately portray the subsurface?	Y
b. Will the derived data be reliable?	Y
c. Have the assumptions been identified? Report not out	~~Y~~ N
d. Have the physical and chemical properties of the site-specific wastes and hazardous waste constituentsbeen identified?	Y
J. Conclusions	
1. Subsurface geology	
a. Has sufficient data been collected to adequately define petrography and petrographic variation?	Y
b. Has the subsurface geochemistry been adequately defined? very complex report not out	
c. Was the boring/coring program adequate to definesubsurface geologic variation?	Y
d. Was the owner/operator's narrative description complete and accurate in its interpretation of the data?	Y
e. Does the geologic assessment address or provide means to resolve any information gaps?	
2. Ground-water flowpaths	
a. Did the owner/operator adequately establish the hori-zontal and vertical components of ground-water flow?	Y 107

	Y/N
b. Were appropriate methods used to establish ground-water flowpaths?	Y
c. Did the owner/operator provide accurate documentation?	N
d. Are the potentiometric surface measurements valid?	Y
e. Did the owner/operator adequately consider the seasonal and temporal effects on the ground-water?	N
f. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variationin hydraulic conductivity in the entire hydrogeologic subsurface below the site? Yes for till wells but facility relying on regional reports for s&g aquifer	N
3. Uppermost Aquifer a. Did the owner/operator adequately define the upper-most aquifer?	Y
4. Monitoring Well Construction and Design a. Do the design and construction of the owner/operator's ground-water monitoring wells permit depth discrete ground-water samples to be taken?	Y
b. Are the samples representative of ground-water quality?	Y
c. Are the ground-water monitoring wells structurally stable?	Y
d. Does the ground-water monitoring well's design and construction permit an accurate assessment of aquifer characteristics?	Y
5. Detection Monitoring a. Downgradient Wells • Do the location, and screen lengths of the ground-water monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer?	
b. Upgradient Wells • Do the location and screen lengths of the upgradient (background) ground-water monitoring wells ensure the capability of collecting ground-water samples representative of upgradient (background) ground-water quality including any ambient heterogenous chemical characteristics?	
6. Assessment Monitoring a. Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration?	Y
b. Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release?	~~108~~ N

No detection monitoring system currently active at limit of RCRA unit

→ First determination not made yet.	Y/N
c. Are the procedures used to make a first determinationof contamination adequate?	Y
d. Is the assessment plan adequate to detect, characterize, and track contaminant migration?	N
e. Will the assessment monitoring weils, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes? more wells needed to define [illegible] extent [illegible]	N
f. Are the assessment monitoring wells adequately designed and constructed?	Y
g. Are the sampling and analysis procedures adequate to provide true measures of contamination?	Y
h. Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume?	Y
i. Are the data collected at sufficient frequency and duration to adequately determine the rate of migration?	Y
j. Is the schedule of implementation adequate? [illegible]	~~Y~~ N
k. Is the owner/operator's assessment monitoring plan adequate?	~~Y~~ N
• If the owner/operator had to implement hisassessment monitoring plan, was it implemented satisfactorily? [illegible] ongoing but additional action to monitor only is not appropriate	Y

II. Field Evaluation

A. Ground-Water Monitoring System

1. Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3.)	✓

B. Monitoring Well Construction

1. Identify construction material material diameter a. Primary Casing [illegible] b. Secondary or outside casing [illegible]	
2. Is the upper portion of the borehole sealed with conrete to prevent infiltration from the surface?	Y
3. Is the well fitted with an above-ground protective device?	Y
4. Is the protective cover fitted with locks to prevent tampering? If a facility utilizes more than a single well design, answer the above questions for each well design?	Y

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	Y/N
III. Review of Sample Collection Procedures	
A. Measurement of Well Depths /Elevation	
1. Are measurements of both depth to standing water and depth to the bottom of the well made? [illegible] in 360 & 2000 series wells. wells (2300 & 1000) [illegible] sounded	N
2. Are measurements taken to the 0.01 feet? Taken to 0.05 [illegible] out [illegible] series several feet.	N
3. What device is used? electronic water level device ([illegible])	X
4. Is there a reference point established by a licensed surveyor?	Y
5. Is the measuring equipment properly cleaned betweenwll locations to prevent cross contamination? rinsed with distilled water.	Y
B. Detection of Immiscible Layers	
1. Are procedures used which will detect light phase immiscible layers?	N
2. Are procedures used which will detect heavy phase immiscible layers?	N
C. Sampling of Immiscible Layers	
1. Are the immiscible layers sampled separately prior to well evacuation?	N/A
2. Do the procedures used minimize mixing with watersoluble phases?	N/A
D. Well Evacuation	
1. Are low yielding wells evacuated to dryness?	Y
2. Are high yielding wells evacuated so that at least three casing volumes are removed?	Y
3. What device is used to evacuate the wells? submersible pump in deep wells. bailer in shallow wells.	
4. If any problems are encountered (e.g., equipmentmalfunction) are they noted in a field logbook? note keeping is very good.	Y
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	Y/N
E. Sample Withdrawal	
1. For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers?	Y
2. Are samples withdrawn with either flurocarbon/resins or stainless steel (316, 304 or 2205) sampling devices?	Y
3. Are sampling devices either bottom valve bailers or positive gas displacement bladder pumps? use submersible pump for purging & collection of [illegible] & [illegible] pump & use bailer for [illegible]	
4. If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer? dedicated nylon rope	—
5. If bladder pumps are used, are they operated in acontinuous manner to prevent aeration of the sample?	N/A
6. If bailers are used, are they lowered slowly to prevent degassing of the water? bailers dropped & handled very roughly in water	N
7. If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration?	Y
8. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well?	/
9. If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples? [illegible] & pumps not disassembled [illegible] rinsed down [illegible]	N
10. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps:	
a. Dilute acid rinse (HNO_3 or HC1)?11. If samples are for organic analysis, does the cleaning procedure include the following sequential steps:	Y
11. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps:	
a. Nonphosphate detergent wash?	Y
b. Tap water rinse?	~~Y~~ N
c. Distilled/deionized water rinse?	Y
d. ~~Acetone~~ rinse? methanol	Y
e. Pesticide-grade hexane rinse?	Y

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	Y/N
12. Is sampling equipment thoroughly dry before use?	N
13. Are equipment blanks taken to ensure that sample cross-contamination has not occurred?	Y
14. If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min?	N/A
F. In-situ or Field Analyses	
1. Are the following labile (chemically unstable) parameters determined in the field:	
a. pH?	Y
b. Temperature?	Y
c. Specific conductivity?	Y
d. ~~Redox potential~~? [illegible]	N
e. Chlorine?	N
f. Dissolved oxygen?	Y
g. Turbidity? (at well development only)	N
h. Other (specify) ______	
2. For in-situ determinations, are they made after well evacuation and sample removal? [illegible] during well sampling	Y
3. If sample is withdrawn from the well, is parameter measured from a split portion?	N/A
4. Is monitoring equipment calibrated according to manufacturers' specifications and consistent with SW-846?	Y
5. Is the date, procedure, and maintenance for equipment calibration documented in the field logbook? Field logs document daily calibration	Y
IV. Review of Sample Preservation and Handling Procedures	
A. Sample Containers	
1. Are samples transferred from the sampling device directly to their compatible containers?	Y
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	Y/N
2. Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps?	Y
3. Are sample containers for organics analysis glass bottles with fluorocarbonresin-lined caps?	Y
4. If glass bottles are used for metals samples are the caps fluorocarbonresin-lined?	N/A
5. Are the sample containers for metal analyses cleanedusing these sequential steps:	
a. Nonphosphate detergent wash? All sample bottles are obtained from	
b. 1:1 nitric acid rinse? I-Chem with appropriate	
c. Tap water rinse? cleaning & QA procedures.	
d. 1:1 hydrochloric acid rinse?	
e. Tap water rinse?	
f. Distilled/deionized water rinse?	
6. Are the sample containers for organic analyses cleaned using these sequential steps:	
a. Nonphosphate detergent/hot water wash?	
b. Tap water rinse?	
c. Distilled/deionized water rinse?	
d. Acetone rinse?	
e. Pesticide-grade hexane rinse?	
7. Are trip blanks used for each sample container type to verify cleanliness?	
B. Sample Preservation Procedures	
1. Are samples for the following analyses cooled to 4°C:	
a. TOC?	Not collected
b. TOX?	Y
c. Chloride?	N/A
d. Phenols? ~~[illegible]~~	— N/A
e. Sulfate?	Y
f. Nitrate?	Y
g. Coliform bacteria?	— NA
h. Cyanide?	— N/A
i. Oil and grease?	— N/A
j. Hazardous constituents (}261, Appendix VIII)? Subset which are site specific	~~Y~~13

	Y/N
2. Are samples for the following analyses field acidified to pH <2 with HNO_3:	
a. Iron?	- Y
b. Manganese?	- Y
c. Sodium?	- Y
d. Total metals?	NA
e. Dissolved metals?	Y
f. Fluoride?	N
g. Endrin?	- NA
h. Lindane?	- NA
i. Methoxychlor?	- NA
j. Toxaphene?	- NA
k. 2,4, D?	- NA
l. 2,4,5 TP Silvex?	- NA
m. Radium?	Y
n. Gross alpha?	Y
o. Gross beta?	Y
3. Are samples for the following analyses field acidfied to pH <2 with H_2SO_4:	
a. Phenols?	N/A
b. Oil and grease?	N/A
4. Is the sample for TOC analyses field acified to pH <2 with HCl?	not required
5. Is the sample for TOX analysis preserved with 1 ml of 1.1 ■ sodium sulfite?	N
6. Is the sample for cyanide analysis preserved with NaOH to pH >12?	N/A
C. Special Handling Considerations	
1. Are organic samples handled without filtering?	Y
2. Are samples for volatile organics transfered to the appropriate vials to eliminate headspace over the sample?	Y
3. Are samples for metal analysis split into two portions?	N
4. Is the sample for dissolved metals filtered through a 0.45 micron filter?	Y
5. Is the second portion not filtered and analyzed for total metals?	N
6. Is one equipment blank prepared each day of ground-water sampling?	N 114

	Y/N
V. Review of Chain-of-Custody Procedures	
A. Sample Labels	
1. Are sample labels used?	Y
2. Do they provide the following information:	
a. Sample identification number?	Y
b. Name of collector?	Y
c. Date and time of collection?	Y
d. Place of collection?	Y
e. Parameter(s) requested and preservitives used?	Y
3. Do they remain legible even if wet?	Y
B. Sample Seals	
1. Are sample seals placed on those containers to ensure samples are not altered?	Y
C. Field Logbook	
1. Is a field logbook maintained?	Y
2. Does it document the following:	
a. Purpose of sampling (e.g., detection or assesment)?	
b. Location of well(s)?	
c. Total depth of each well?	
d. Static water level depth and measurement technique?	
e. Presence of immiscible layers and detection method?	
f. Collection method for immiscible layers and sample identification numbers?	
g. Well evacuation procedures?	
h. Sample withdrawal procedure?	
i. Date and time of collection?	
j. Well sampling sequence?	
k. Types of sample containers and sample identification number(s)?	
l. Preservative(s) used?	
m. Parameters requested?	
n. Field analysis data and method(s)?	
o. Sample distribution and transporter?	
p. Field observations?	115

	Y/N
—Unusual well recharge rates?	
—Equipment malfunction(s)?	
—Possible sample contamination?	
—Sampling rate?	
D. Chain-of-Custody Record 1. Is a chain-of-custody record included with each sample?	
2. Does it document the following: a. Sample number?	Y
b. Signiture of collector?	Y
c. Date and time of collection?	Y
d. Sample type?	Y
e. Station location?	Y
f. Number of containers?	✓
g. Parameters requested?	Y
h. Signatures of persons involved in chain-of-custody?	Y
i. Inclusive dates of custody?	Y
E. Sample Analysis Request Sheet 1. Does a sample analysis request sheet accompany each ~~sample~~? cooler	Y
2. Does the request sheet document the following: a. Name of ~~person~~ laboratory receiving the sample?	✓
b. Date of sample receipt?	Y
c. Duplicates?	—
d. Analysis to be performed?	✓
IV. Review of Quality Assurance/Quality Control **A. Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program?**	
B. Does the QA/QC program include: 1. Documentation of any deviation from approved procedures?	116

	Y/N
2. Documentation of analytical results for: a. Blanks?	Y
b. Standards?	
c. Duplicates?	Y
d. Spiked samples?	Y
e. Detectable limits for each parameter being analyzed?	Y
C. Are approved statistical methods used?	N/A
D. Are QC samples used to correct data?	
E. Are all data critically examined to ensure it has been properly calculated and reported?	
VII. Surficial Well Inspection and Field Observation A. Are the wells adequately maintained?	Y
B. Are the monitoring wells protected and secure?	Y
C. Do the wells have surveyed casing elevations?	Y
D. Are the ground-water samples turbid?	N
E. Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)?	Y
F. Has a site sketch been prepared by the field inspector with scale, north arrow, location(s) of buildings, location(s) of regulated units, locations of monitoring wells, and a rough depiction of the site drainage pattern?	N
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	Y/N
VIII. Conclusions	
A. Is the facilitycurrently operating under the correct monitoring progaram according to the statistical analyses performed by the current operator? Facility in assessmnt. monitoring	N
B. Does the ground-water monitoring system, as designed and operated, allow for detection or assessment of any possible ground-water contamination caused by the facility? monitoring only the perimeter of waste pit area which has numerous potential cont. sources.	N
C. Does the sampling and analysis procedures permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility?	N
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APPENDIX A-1 **

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER MONITORING

Company Name: ~~Feed Materials Production Co~~ FMPC; EPA I.D. Number: OH6890008976

Company Address: ____________; Inspector's Name: E. Schuessler

Ferlald, Ohio

Company Contact/Official: Jack Craig; Branch/Organization: DOE

Title: RCRA Division; Date of Inspection: 6/26/89

Type of facility: (check appropriately)	Yes	No	Unknown
a) surface impoundment	___	___	
b) landfill	X	___	
c) land treatment facility	___	___	
d) storage facility	___	___	

Ground-Water Monitoring Plan

	Yes	No	Unknown
1. Has a ground-water monitoring plan been submitted to the Regional Administrator for facilities containing a surface impoundment, landfill, land treatment process, or storage facility?	___	/	___
2. Was the ground-water monitoring plan reviewed prior to site visit? If "No",	X	___	
a) Was the ground-water plan reviewed at the facility prior to actual site inspection? If "No", explain.	___	___	

** Facility no longer in detection monitoring -- See check list A-2

	Yes	No	Unknown
3. Has a ground-water monitoring program (capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility) been implemented? 265.90(a)	X		
4. Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 265.91(a)(1)	X		
a) Are sufficient ground-water samples from the uppermost aquifer, representative of background ground-water quality and not affected by the facility, ensured by proper well			
1) Number(s)?	X		
2) Location?	X		
3) Depth?		X	well screens two aquifers.
5. Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 265.91(a)	X		
6. Have the locations of the waste handling, storage, or disposal areas been verified to conform with information in the ground-water plan?	X		
7. Do the numbers, locations, and depths of the ground-water monitoring wells agree with the data in the ground-water monitoring system program? If "No", explain discrepancies.	X		

	Yes	No	Unknown
8. Has a ground-water sampling and analysis plan been developed? 265.92(a)	X	___	___
a) Has it been followed?	X	___	___
b) Is the plan kept at the facility?	X	___	___
c) Does the plan include procedures and techniques for:			
1) Sample collection?	X	___	
2) Sample preservation?	X	___	
3) Sa: :ple shipment?	X	___	
4) Analytical procedures?	X	___	
5) Chain of custody control?	X	___	
9. Are the required parameters in ground-water samples planned to be tested quarterly for the first year? 265.92(b) and 265.92 (c)(1)	___	___	
a) Are the ground-water samples analyzed for the following:			
1) Parameters characterizing the suitability of the ground-water as a drinking supply? 265.92(b)(1)	X	___	
2) Parameters establishing ground-water qaulity? 265.92(b)(2)	X	___	
3) Parameters used as indicators of ground-water contamination? 265.92(b)(2)	___	___	
(i) Are at least four replicate measurements obtained for each sample? 265.92(c)(2)	X	___	tox not analyzed for in round 1 we 14S and round 2 well 21TP.
(ii) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from well(s) during the first year? 265.92(c)(2)	X	___	
b) For facilities which have complied with first year ground-water sampling and analysis requirements:			
1) Have samples been obtained and analyzed for the ground-water qaulity parameters at least annually? 265.92(d)(1)	X	___	
2) Have samples been obtained and analyzed for the indicators of ground-water contamination at least semi-annually? 265.92(d)(2)	X	___	

	Yes	No	Unknown
c) Were ground-water surface elevations determined at each monitoring well each time a sample was taken? 265.92(e)		X	
d) Were the ground-water surface elevations evaluated to determine whether the monitoring wells are properly placed? 265.93(f)		X	
e) If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 265.91(a)? 265.93(f)		X	
10. Has an outline of a ground-water quality assessment program been prepared? 265.93(a)	X		yes as of 1987 & revised in 1989.
a) Does it describe a program capable of determining:			1989 plan
1) Whether hazardous waste or hazardous waste constituents have entered the ground water?		X	
2) The rate and extent of migration of hazardous waste or hazardous waste constituents?		X	
3) Concentrations of hazardous waste or hazardous waste constituents in in ground water?		X	
b) Have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 265.93(b)	X	except for TOX as noted above.	
1) Were the results compared with the initial background mean?	X		
(i) Was each well considered individually?	X		
(ii) Was the Student's t-test used (at the 0.01 level of significance)?	X		
→ 0.05 level of significance but still triggered into assessment.			
2) Was a significant increase (or pH decrease) found in the:			
(i) Upgradient wells		X	
(ii) Downgradient wells	X		
If "Yes", Compliance Checklist A-2 must also be completed.			

	Yes	No	Unknown
11. Have records been kept of analyses for parameters establishing ground-water quality and indicators of ground-water contamination? 265.94(a)(1)	X		
12. Have records been kept of ground-water surface elevations taken at the time of sampling for each well? 265.94(a)(1)	X		
13. Have the following been submitted to the Regional Administrator 265.94(a)(2) :			
a) Initial background concentrations of parameters listed in 265.92(b) within 15 days after completing each quarterly analysis required during the first year?	X		
b) For each well, any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies?	X		
c) Annual reports including:	Did not Find in Files		
1) Concentrations or values of parameters used as indicators of ground-water contamination for each well?			
2) Results of the evaluation of ground-water surface elevations?			

APPENDIX A-2

INSPECTION COMPLIANCE FORM FOR A FACILITY WHICH HAS DETERMINED IT MAY BE AFFECTING GROUND-WATER QUALITY

Company Name: FMPC ; EPA I.D. Number: 0H 6890 008976

Company Address: ; Inspector's Name: E. Schuessler

Fernald, Ohio

Company Contact/Official: Jack Craig ; Branch/Organization: DOE

Title: RCRA Division ; Date of Inspection: 6/26/89

	Yes	No	Unknown
Type of facility: (Check appropriately)			
a) surface impoundment			
b) landfill	X		
c) land treatment facility			
d) storage facility			

Ground-Water Monitoring Plan

	Yes	No	Unknown
1. Has(Have) comparison(s) of ground-water contamination indicator parameters for the upgradient well(s) 265.93(b) shown a significant increase (or pH decrease) over initial background?		X	
a) If "Yes", has(have) the increases(s) been submitted to the Regional Administrator as part of the annual report? 265.94(a)(2)(ii)			
2. Have comparisons of indicator parameters for the downgradient wells 265.93(b) shown a significant increase (or decrease) over initial background?	X		
a) If "Yes", were additional ground-water samples taken for those downgradient wells where the significant difference was determined? 265.93(c)(2)	X	but not untill 6 mo. later	
1) Were samples split in two?		X	
2) Was the significant difference due to laboratory error? (If "Yes", do not continue.)		X	

	Yes	No	Unknown
3. If significant differences were not due to laboratory error, was a written notice sent to the Regional Administrator within 7 days of (laboratory) confirmation?	X		
4. Within 15 days of notification of the Regional Administrator was a ground-water quality assessment program submitted? 265.93(d)(2)	X		
a) Does the plan specify 265.93(d)(3) :			
1) Well information (specifics)			
(a) number?	X		
(b) locations?	X		
(c) depths?	X		
2) Sampling methods?	X		most TOC/TOX missing
3) analytical methods?	X		
4) evaluation methods?	X		
5) schedule of implementation?	X		
yes but very vague & gener			
b) Does the plan allow for determination of 265.93(d)(4) :			
1) Rate and extent of migration of hazardous waste or hazardous waste constituents?		X	
2) Concentrations of the hazardous waste or hazardous waste constituents?		X	
c) Is it indicated that the 1st determination was made as soon as technically feasible? 265.93(d)(5)		X	Assessment has undergone 4 rounds as of 7/2 & no 1st determination made
1) Within 15 days after determination was a written report containing the assessment of ground-water quality submitted to the Regional Administrator?			
d) Was it determined that hazardous waste or hazardous waste constituents from the facility has entered the ground water?		X	Facility stated that they have not made their 1st determination of this -- see repor However the plan is inadequate & has not been implemented to det this.
1) If "No", was the original indication evaluation program, required by 265.92, reinstated?			
(a) Was the Regional Administrator notified of the reinstatement of program within 15 days of the determination? 265.93(d)(7)			

	Yes	No	Unknown
e) If it was determined that hazardous waste or hazardous waste constituents have entered the ground water 265.93(d)(7) :			
1) For facilities where program was implemented prior to final closure, are determinations of hazardous waste or hazardous waste constituents continued on a quarterly basis? (If program was implemented during the post-closure care period, determinations made in accordance with the ground-water quality assessment plan may cease.)	X		
(a) Were ground-water quality reports submitted to the Regional Administrator within 15 days of determination?			
2) Were(are) records kept of the analyses and evaluations, specified in the ground-water qaulity assessment (throughout the active life of the facility)? 265.94(b)(1)			can not determine. Annual report { RI/FS data base missing several analytical results. For Assessment monitoring wells.
(a) If a disposal facility, were(are) records dept throughout the post-closure period as well?			
f) Are annual reports submitted to the Regional Administrator containing the results of the ground-water quality assessment program? 265.94(b)(2)	X		could not Fin. 1987. report.
1) Do the reports include the calculated or measured rate of migration of hazardous waste or hazardous waste constituents?		X	